

T. Ascra sp.

J. De C. Smeets inv.

A  
PRACTICAL TREATISE  
ON  
VARIOLA OVINA,  
OR,  
SMALL-POX IN SHEEP,  
CONTAINING THE  
HISTORY OF ITS RECENT INTRODUCTION INTO ENGLAND;  
WITH THE PROGRESS, SYMPTOMS, AND TREATMENT  
OF THE DISEASE;  
ALSO THE EXPERIMENTS INSTITUTED TO ASCERTAIN ITS  
PECULIAR FEATURES, AND THE BEST MEANS TO  
AVERT ITS FATAL CONSEQUENCES.

ILLUSTRATED WITH COLOURED PLATES.

BY  
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VENIENTI OCCURRITE MORBO.  
—

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1848.



TO THE COUNCIL  
OF THE  
ROYAL AGRICULTURAL SOCIETY OF ENGLAND,

Whose indefatigable exertions tend to increase the national  
Wealth and Prosperity,

By the advancement of that which is their true staple, namely,

AGRICULTURE;

As well as of

All the other branches of Art and Knowledge that depend upon the  
Cultivation of the Soil, and especially

THE SCIENCE OF VETERINARY MEDICINE,

As applied to Cattle and Sheep;

And this, not merely by the diffusion of enlightened views,  
but also by the most generous care  
and pecuniary liberality;

THIS WORK IS DEDICATED,

In the hope of aiding, although in a humble manner, in the same  
great objects,

By their very obedient, humble servant,

THE AUTHOR.



## P R E F A C E.

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THIS Essay is based on a series of experiments which were instituted by the author in consequence of the sudden appearance of a malignant exanthematous disease in the flocks of several agriculturists in the vicinity of London, and which seemingly depended on the sheep being mixed with some imported “merinos.” An examination shewed that the malady possessed many of the features of human variola, and was, in fact, the small-pox of sheep.

Originally the author intended to have placed the matter before the veterinary profession in particular in a series of papers in the “Veterinary Record;” but, finding that the disease rapidly extended, he resolved to bring his researches into its nature and treatment before the public in the form of a pamphlet. And he would fain indulge the hope that, in taking this course, he may be instrumental in benefitting the agricultural community, whose flocks are in danger of being decimated by a scourge which previously had confined its ravages to the continent. The work has been written during the intervals of professional avocations, combined with the delivery of a sessional course of instruction, and the author is well aware of its many imperfections; yet he hopes it will be found to contain at least an outline of what is known on the subject. He could have wished that the task had devolved on one more capable of doing it justice; but, considering the situation which he has the honour to hold, namely, the Lectureship on the Anatomy and Diseases of Cattle at the Royal Veterinary College, he felt that it was a duty from

which he ought not to shrink. He has gleaned information from various sources, and has made free use of the labours of the continental pathologists, rather preferring to do this, in many instances, than to promulgate opinions of his own. In accomplishing his design, he trusts that he has rendered an acceptable service to his profession, and also one which will be deemed not altogether valueless by the practitioners of medical science. He is emboldened to make this latter remark, by observing that Dr. Gregory, Physician to the Small-pox Hospital, in his annual report, after narrating the particulars of the outbreak, and of the experiments, says that "the resemblance of this disease to small-pox is very remarkable, both in symptoms, mode of communication, and rate of mortality;" and "when fully developed, the investigation can hardly fail to throw some new and valuable light on the history of small-pox, and on the relation which it bears to other diseases, both of man and animals."

In conclusion, the author has to acknowledge his obligations to many medical friends, among whom he wishes particularly to name, Mr. Ceely, Mr. Marson, and Mr. Erasmus Wilson; and he is equally indebted to his colleagues Professors Sewell, Spooner, and Morton, and also to Mr. Varnell, for assistance and advice in carrying out the investigations.

Royal Veterinary College, April 27, 1848.

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# VARIOLA OVINA ;

OR,

## S M A L L - P O X I N S H E E P .

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### CHAPTER I.

OPINIONS OF BRITISH AUTHORS ON SHEEP-POX—ANTIENT WRITERS ON DISEASES OF CATTLE—EPIZOÖTIC AFFECTIONS, INCLUDING SHEEP-POX—GENERAL HISTORY OF THESE MALADIES—VISITATION OF THEM IN ENGLAND—THEIR SUPPOSED CAUSES.

THE outbreak of a disease in any locality where it had hitherto been unobserved or unknown, except by name, cannot fail, whether man or animals be its victims, to excite the attention of the public; but more especially must it receive attention from those persons whose avocation requires that they should investigate the causes which have led to its appearance, and make themselves conversant with its nature or character, and with the laws which govern its extension among that class of animals which seems most susceptible of its influence.

No surprise need, therefore, be felt at the interest which has been awakened by the appearance in this country of a disease attacking sheep, and having a strong resemblance to, if not identity with, that loathsome malady, the SMALL-POX. This ovine disorder now bids fair to establish itself in England, and pro-

bably from time to time to break forth and decimate our flocks, as variola does, or used to do, our population\*. Of late years both our cattle and sheep have suffered severely from epizoötics, and we cannot but regret that the disease we are now treating of should be added to the number of these scourges ; for the interests not merely of the agriculturists, but of the whole community, must be seriously compromised if it is found to extend itself, as we have great reason to fear that it may do, since accounts are frequently reaching us of its having broken out in different and new places in the kingdom.

Variola Ovina is spoken of as a very destructive complaint in most parts of the continent, and several of those who have written on the subject, tell us that it frequently assumes the epizoötic type ; many sheep probably being attacked during some seasons, and fewer in others. From the earliest periods down to the present time malignant diseases have raged on the continent, and some of them have visited England ; a question might, therefore, arise, has sheep-pox been one of the number ? To this it is, perhaps, impossible to give a decided negative ; but we incline to the opinion, that this malady has

\* But a few years have elapsed since small-pox broke out with fearful violence in the city of Norwich, and carried off a large number of its inhabitants. Mr. Cross, writing of the affection, says : " It was comparatively dormant during the winter, and when the season became milder, it burst upon us suddenly and unexpectedly, continuing its work of devastation for three or four months with undiminishing fury." ' Upwards of 3000 persons, or a thirteenth part of the whole population were affected ; the total deaths were for the year [1819], 1352, and of these 530 died from small-pox, and 822 from all other causes.'—*A History of the Variolous Epidemic*, p. 4, 5, 8vo, London, 1820.

never till now existed here as an epizoötic. To the best of our knowledge, no British author has described such a visitation, although several have handed down very full particulars relating to these epidemics. Mr. Youatt, in his work on *Sheep* (p. 541, 1837), speaking of *Clavelée*, the French name for the affection, says “it never reached Great Britain, although it has thinned the sheep flocks in every district of France, opposite to the English coast.” Mr. James Hogg, “the Ettrick Shepherd,” makes no mention of sheep-pox from his own experience, but gives an account of it in a translation from the French of M. Vitet; and it appears most probable that he was a stranger to the malady, for in a short article which precedes the translation alluded to, he observes, “that sundry of the diseases here treated of are analogous to those in our own country, consequently the cures must also be of use here; and though others of them have not yet appeared in Britain, the *introduction of foreign breeds may introduce foreign diseases.* This we can neither guard too well against, nor be too well prepared for when it happens” (p. 191, Edinburgh, 1807). If, however, we turn to the pages of earlier authors on the disorders of cattle, we find mention made of a malady called sheep-pox ; but it must be borne in mind, that there is not much originality in their writings, which are often made up of translations from Italian and other Continental books.

Leonard Mascal, in his work on cattle, in the third book, where he treats of *The Government of Sheep*, makes these remarks : “Sheepe wil haue a scab, which shepheards call the pocks, and it wil appeare on the skin, like red pimples or purples, and they wil be broad

like spots as broad as farthings, and there dieth many sheepe thereof, for lacke of looking too betimes. Therefore to handle often all your sheepe, and looke all ouer their bodies, and see if ye find any sheep taken therewith : ye shal by and by take him from his fellows, and put him into some fresh pasture. And then see and looke daily to the rest of the flock, and draw them as ye shal see them infected therewith, and put them in fresh pastures if they haue it, in somer when there is no frostes, then it shalbe good to wash them in water. Remedies also. Some do take ye iuice of nightshade mixt with grease, and therewith anoint, or garlick beaten togither with tar, and so anoint. Or the iuice of pelitory of Spain, or of artichoke, mixt with strong vinegar, and therewith wash it. Other remedies shepheards haue the which I know not, but these I thinke shalbe sufficient," (4to, London, 1587, p. 231-2).

Ruscam, Gervase Markham, James Lambert, and others, who wrote shortly after Mascal, either copy his observations, or merely give their own recipes for the cure of the complaint. Ellis in his *Sure Shepherd's Guide* (page 324), speaking of the disorder, says, "My next neighbour had one [sheep] that came out in blotches from its horn to its mouth ; to cure it he made use of tar." The malady here indicated might be sheep-pox, or, what is more likely, an eruptive affection to which the ovine race are liable ; but arising from ordinary causes, as exposure to inclement weather, &c. Thus Virgil says,

"A scabby tetter on their pelts will stick,  
When the raw rain has pierced them to the quick."

GEORGIC III, *Dryden's Translation*, l. 672.

Ellis wrote in 1749, and since his time we find no mention made of this disease as affecting the sheep of this country: in fine, the only notice taken of it by English authors appears to arise from the introduction into their works of translations from foreign writers, as we have explained already. We, therefore, consider that the weight of evidence favours the opinion, that the outbreak of "variola ovina," which we are about to describe, depends on the importation of certain infected animals from abroad, and this will be greatly strengthened by a perusal of the facts which the sequel will disclose. Our insular position has, no doubt, protected us from many pestiferous affections that have proved destructive to cattle in France, Germany, Italy, and other Continental states; epidemics in which contact is absolutely necessary to convey the disease; for although several of these maladies are both infectious and contagious, we must remember that they are only so within a given distance, this is probably the case with variola ovina.

We shall now proceed to take a brief view of these pestilential scourges, which we are the more desirous of doing, because some of them appear to have points in common with the malady here treated of.

The most ancient records of both Scriptural and Pagan history make frequent mention of such epidemics; and, in the time of Moses, we first learn that Egypt had her cattle swept off by what was called "murrain," a term, perhaps, employed to designate a class of diseases. The cause of this dreadful visitation was the disobedience of Pharaoh to God's commands, in detaining the children of Israel; and, it is related,

that all kinds of animals fell victims to the scourge. "The Lord did that thing on the morrow, and all the cattle in Egypt died." Are we to look upon this as a Divine punishment, employed on a specific occasion, and to cease for ever afterwards ? Or, rather, may we not consider that here was a beginning of certain diseases which, governed by particular laws, were destined, from time to time, to lay low the flocks and herds of other nations, sparing not even man himself ? However much the origin or causes of these maladies may be beyond our ken, we have positive proof of their effects ; and, since the period referred to in the Bible, epizoötic disorders have been so frequent, as to attract the attention of historians in all countries.

To the early poets of Greece and Rome we are indebted for accounts of some of these visitations ; frequent allusions being made to them in the writings of Homer, who flourished about 900 years before the Christian era. Virgil and Ovid also furnish graphic descriptions of them.

Virgil thus writes,

" On winter seas we fewer storms behold  
Than foul diseases that infect the fold.  
Nor do these ills on single bodies prey,  
But oft'ner bring the nation to decay,  
And sweep the present stock and future hope away.

A dire example of this truth appears,  
When, after such a length of rolling years,  
We see the naked Alps, and their remains  
Of scattered cots and yet unpeopled plains,  
Once fill'd with grazing flocks, the shepherd's happy reigns.

Here, from the vicious air and sickly skies  
A plague did on the dumb creation rise :

During the autumnal heats the infection grew,  
Tame cattle and the beasts of nature slew ;  
\* \* \* \* \* \*  
\* \* \* \* \* \*  
Sheep, oxen, horses fell, and, heaped on high,  
The diff'ring species in confusion lie\*.”

Such is a poetical account of one of these epizoötics, as it raged among the Alps, probably not less than 2000 years since. We also learn from Plutarch that, in the days of Romulus, or about the time that Rome was founded (750 B.C.), a great plague, after destroying the fruits of the earth and the cattle, swept off many of the people. And Livy says, “ The consuls had the greater difficulty to raise their recruits, because the plague, which the year before had raged among horned cattle, broke out among men.” We find, however, that Varro and others, the earliest writers on husbandry, are nearly silent on these affections. Columella, the author of one of the most valuable works on Roman agriculture, and who flourished shortly after the birth of Christ, views them as contagious disorders, and has handed down some instructions for their cure. It is not until the fourth century, when they are again mentioned by Vegetius, that we have much further information about them. This veterinary writer, after describing several varieties of “ the distemper or plague,” goes on to observe :—“ All these diseases are full of contagion, and if they seize an animal, they pass immediately to all ; and so they bring destruction sometimes either upon whole herds, or upon all those that are tame and broke for labour. Therefore the animals which have been once attacked, must, with all diligence and care, be separated from the herd, and put apart by themselves, and sent to

\* GEORGIC 3, l. 711—829, Dryden's translation.

those places where no animal is pastured, lest, by their contagion, they endanger all the rest, and what results from the negligence of the owner be imputed, as is usually done by fools, to the Divine displeasure\*." Cardinal Baronius states, that in the year 376, when the cattle died of the plague all over Europe, none escaped but such as were marked on the forehead with the sign of the cross, by which miraculous immunity many persons are said to have been converted to the Christian faith.

In the year 810, it is stated that an epizoötic raged to such an extent as to destroy every head of cattle in the Emperor Charlemagne's army, and to have been fearfully destructive throughout the German empire. It would be useless at present to attempt to trace the history of epidemics in the dark ages.

In the sixteenth century, however, various outbreaks are related of malignant affections among cattle ; and Rammazini records that the Venetian states suffered greatly in 1514 and 1599, when "all beef and veal, and likewise milk, were forbidden by the senate to be eaten." He also says, that at Modena, in 1690, the season was cold and moist ; and the distemper of that year attacked all the people who lived in the country, and spread indiscriminately among all kinds of animals, killing great numbers after a few days' illness. Nature made strong efforts to disengage herself from the disease. A critical discharge manifested itself on the thighs, neck, and head, resembling the pustules of small-pox. Most of the animals which had this appearance, *lost their eyesight*. Those creatures which were not carried off by the disease, but resisted its first vio-

\* Translation of Vegetius Renatus on Diseases of Horses and Oxen. London, 8vo, 1748, p. 227-8.

lence, lost their flesh by degrees, and fell into a marasmus.

Rammazini did not scruple to declare these pustules to be the *small-pox*; for they differed not from it in form, in colour, or in the manner in which they went off: when they had dried off after the suppuration, they left a black scar, like that which remains after the small-pox. This epidemic contagion continued in 1691, and attacked chiefly *the sheep*, so violently that the breed was almost destroyed. It has been constantly observed, that of all animals *sheep are the most subject to small-pox*. It was, therefore, to be expected that they should be particularly affected with it, since they are more disposed to it than other cattle\*.”

In 1693 pulmonary phthisis proved very destructive to oxen, and “Hesse saw her herds carried off by it:” the supposed cause being the changeable condition of the atmosphere.

Lower Hungary is said to have suffered severely in 1712, at the early part of the year, from a malady attacking the cattle which is not very clearly described; but in August of the same year we learn “that a new kind of disorder shewed itself, associated with white pustules filled with matter insufferably stinking.” And MILLS adds, that “every circumstance, especially the pustules, declare this distemper to have been the small-pox, complicated with some other disease. The liquor which flowed from the mouth greatly resembled the spitting which comes on in men in the small-pox. The difficulty of breathing, the stench of the breath, and the infectious smell of the pustules, are symptoms which constantly attend the *clavin*, *claveau*, or small-pox in sheep.”

\* Mills on Cattle, London, 8vo, 1776, p. 407-8.

Of late years the progress of these distempers has been regularly traced in Europe; and the one from which the cattle of Italy, Germany, France, Holland, and Great Britain, suffered in 1711-12, came from Hungary, being imported by some oxen into the neighbourhood of Padua. The infection seems to have been communicated by the saliva, for, say the historians, "when this is dropped on the grass, and sound animals are immediately placed on the same pasture, they contract the disorder, and in some bullocks the tongue was inflamed and covered with many red blisters." From this description it would appear that the malady resembled the one now existing in this country, and to which we have given the name of *Eczema Epizootica*.

In 1713 Rome and its neighbourhood suffered greatly from the same epizoötic. The prophylactic measures had recourse to by Pope Clement XI are said, by Lancisi, to have preserved, for two years, the cattle in the Ecclesiastical dominions; but the disease was then introduced. It is recorded that orders were issued to suppress a fair about to be held at Frusino, a town bordering on the kingdom of Naples, and that the drovers, being thus prevented from disposing of their oxen, took them by circuitous roads to Rome, where they sold them at a low price. This circumstance also facilitated the disposal of many of the cattle to various persons residing in the villages through which they passed, and thus the affection spread through the Papal states, and killed nearly thirty thousand animals in the succeeding nine months; a register having been kept from October 1713 to April 1714, when the malady is stated to have ceased.

In 1730, Bohemia, Saxony, and the Duchy of Magdeburg, were visited by a similar pestilence, the first symptom of which is described to be “a white blister that appeared on the tongue of the affected animals.”

In 1745 the cattle of Italy, France, Germany, and England were destroyed by thousands; and it is worthy of observation, that this disease seems to have been very analogous to, if not identical with, pleuro-pneumonia. By some authors it is said to have been brought from Holland by certain calves imported into the vicinity of London by a farmer for the purpose of crossing the breed; while others assert that the lucrative views of an English tanner, who bought a parcel of distempered hides in Zealand which were forbidden to be sold, was the origin of the affection.

A very good account of the malady has been left to us by Dr. Barker, who in his description of the *post-mortem* appearances, says, “I have constantly found the bloodvessels of the lungs stuffed up, and distended with grumous or coagulated blood, and the bronchia or air-vessels so much inflated as to make the bulk of the lungs appear much larger than usual. And though some of these cattle were opened before the body was cold, or the blood congealed in the other vessels, yet in those of the lungs it was constantly found to be coagulated to such a degree, as not to flow out of the vessels upon cutting them\*.”

We have already made mention of an affection described by Rammazini to be the small-pox, which committed fearful ravages among the sheep at Modena

\* An account of the present epidemical distemper amongst Black Cattle (London, 1745.)

in 1690. We have again to record another outbreak of that disease in 1746, which continued with more or less severity in Picardy till 1792. “The sheep were affected with a contagious malady which the French commonly call *clavin* or *claveau*, and which is, in fact, no other than the small-pox. It is, of all the contagious distempers which affect sheep, the most easily communicated, and that to which they are the most liable. Like the small-pox, too, it is distinguished into the distinct or mild, the confluent or malignant\*.”

In the interval between the above dates, that is, about 1758, another of these epizoötics reached our shores, and many of our cattle died. Dr. Layard describes it as a putrid, malignant, and inflammatory fever, attacking the ox tribe, and producing ulcers in the mucous membranes and external parts of the body; and says that he had often seen *sheep*, pigs, horses, and dogs in the midst of the infectious without being contaminated by it.

In 1763-4 our cattle again fell victims to one of these diseases: the digestive organs were the chief seat of the affection, and parasites were present, viz. intestinal worms, and flukes in the liver. Sheep suffered severely. This disorder seems, however, to have been no other than “*the rot*.”

From this period down to 1838-9 England seems to have escaped; but suddenly in the former year an epizoötic associated with fever, and with vesicles on the tongue, lips, teats, and between the digits, made its appearance among our cattle, attacking oxen, sheep,

\* Mills on Cattle, p. 420.

and pigs; even poultry were similarly affected. This disease would appear to be like that which existed in Saxony in 1730, and probably also in this country in 1711-12: it is too well known to need any particular description. We regret to say that it still continues in the British Islands, and has produced great losses to the owners of stock, although it is rarely now found to prove fatal. That destructive malady pleuro-pneumonia followed closely upon it.

The latest of these epizoötics is the especial object of this treatise, viz. the small-pox among sheep.

Having thus given a condensed history of pestilential affections, which clearly shews that the “Clavalée” has not been among those that have broken out among our flocks and herds, we will now offer a few remarks on the supposed causes of these maladies.

Exposure to the changeable state of the weather, the partaking of bad provender or stagnant water, are viewed by many as the chief causes of epidemics, while others trace them to a vitiated condition of the atmosphere; but whether such state consists of a mingling of mephitic vapours or deleterious gases arising from either animal or vegetable decomposition, or from an excess of humidity or dryness affecting the electrical condition of the air, they scarcely venture to conjecture. That the gaseous compounds eliminated from decomposed animal substances are highly injurious to health, cannot be doubted, although these may not singly originate epidemics; hence one reason of burning or burying the dead. It is, indeed, much to be wished, that all putrescent matters were removed as far as possible from places where they are likely to be injurious to public health.

Virgil, in his description of the causes and effects of an epizootic thus expresses himself,

“ At length whole herds to death at once it sweeps ;  
 High in the stalls it piles the loathsome heaps ;  
 Dire spectacle ! till sage experience found  
 To bury deep the carrion in the ground.  
 Useless their hides, nor from the flesh the flame  
 Could purge the filth, nor steams the savour tame.”

GEORGIC, lib. III, v. 556. *Wharton's translation.*

In the days of Homer the effects were attributed to the offended gods ; but whether his account is, or is not, symbolical of a vitiated air, we cannot determine. The antiquity of such an opinion is clearly shewn by the extracts we have made from Virgil. Ovid also viewed the atmosphere as the chief cause, and, when speaking of the destruction of the island of Ægina, he observes,

“ With deadly blasts the fatal south wind blew,  
 Infected all the air, and poisoned as it flew.  
 \*      \*      \*      \*      \*      \*      \*  
 The tabid sheep with sickly bleatings pines,  
 Its wool fast wasting as its strength declines.”

Livy, too, in his account of a pestilence in his time, imputes it to the air.

Pliny, who wrote a few years afterwards, affirms that these opinions were not general, and that the quality of the food was considered dangerous, more especially the “rust of grass.” He speaks of the disease as an effect of God’s wrath, and observes that Numa Pompilius, the successor of Romulus, instituted festivals called *Rubigalia Festa*, to avert its consequences : these were celebrated in April, because the rust usually began in that month.

In the present state of science we are compelled to admit that the causes of epidemic affections are as little understood as they were centuries since; and although a strict attention to diet, and protection from the vicissitudes of weather, will go far to render animals insusceptible to diseases in general, it must, nevertheless, be admitted, that these means, valuable as they are, do not give absolute immunity from such attacks.

Whatever the combination of causes may be which produces these maladies, certain it is that very many of them assume an infectious nature, otherwise we could not account for animals separated and kept apart from those which are diseased, frequently and sometimes altogether escaping, while those are sure to become early victims that are allowed to pasture or live with the affected; besides, we can often succeed in producing the malady by inoculating healthy cattle, thus shewing how closely the spread of the disorder depends upon contagion or infection. The fact, however, of animals when in health, if placed with affected ones, contracting a disease of the same kind as that which the latter are suffering from, is the best proof of the infectious or contagious nature of a complaint. An animal escaping an attack, when such affections are raging in the locality in which it is placed, may arise from a variety of causes, as non-susceptibility, and also the possibility of the exciting agents never having been brought within its sphere of inhalation. For although each victim to a destructive epidemic may be considered as adding new seeds or fresh energy to the malady by the exhalations arising from its body, we

must not lose sight of the circumstance, that very many infectious diseases assume an endemic type, whilst others which are spread over a vast extent of country are often observed to take a particular direction. There are, however, diseases of this kind that appear to be guided by no determined rules, breaking out again and again in the same neighbourhood; but even here we may suppose, with good reason, that the deleterious atmosphere floats, as it were, *in nebula*, and is driven hither and thither by the currents, sacrificing fresh subjects placed in the course of its passage.

Although, then, "one swallow does not make a summer," yet one positive proof of the communication of disease from animal to animal should render us very cautious, and much influence the opinions we may give on so important a point.

Judging from our present experience and observation, as well as from the facts related to us, we have every reason to fear that *Variola Ovina* is both *contagious and infectious*.

## CHAPTER II.

### HISTORY OF THE INTRODUCTION OF SHEEP-POX INTO ENGLAND—EXPERIMENT OF EXPOSING A SHEEP TO THE DISEASE—INOCULATION WITH THE OVINE VIRUS.

ON September 4th, 1847, I was consulted by Mr. Statham, farmer, of Datchett, near Windsor, with reference to a cutaneous disease of a destructive nature that had broken out among his sheep. I was informed by him that he had purchased fifty-six sheep of the Spanish breed in Smithfield market on the 26th of July. Before putting them with others, he placed them in a separate pasture, with a view to ascertain if they were free from ECZEMA EPIZOÖTICA, which so frequently makes its appearance after sheep have been driven from one place to another. No symptom of this disease having shewn itself at the termination of a week, the sheep were allowed to mingle with a flock of about two hundred "Downs," which at that time appeared to be in perfect health.

A few days subsequently, while going over his grounds, Mr. Statham saw one of the "Spanish sheep" standing apart from the others; and on examining it, he found the surface of its body covered with eruption, which he thought resulted only from the stings of wasps or hornets, and on that account the animal was not removed.

On the following day several more of the "Merinos" were found to be similarly affected; and from this time

the disorder continued to spread, and many of the sheep died.

It was about a fortnight after the two flocks were pastured together, that the malady *first* shewed itself in the Downs, and these seemed to suffer more from it than the Merinos. The flocks were now separated; still the disease continued to advance, and daily losses were sustained.

Before my arrival at Datchett, the sheep had been judiciously divided by Mr. Statham into three lots, which were placed in fields situated at a distance from each other, so as to prevent the disease being communicated by contact or even by infection. The first lot consisted of Downs supposed to be healthy; the second of Merinos recovering from the malady; and the third of Merinos and Downs still labouring under it: the latter I carefully inspected.

Those in the *first* stage of the affection were extremely low in condition; a mucous discharge from the nostrils was present; the breathing was quick and catching; the visible mucous membranes were inflamed, particularly the conjunctival lining of the eyelids, from which tears flowed in large quantities: all food was refused; rumination had ceased; the ears were lopped; the head held low; and a disinclination was evinced by the patients to associate with each other, some standing and having a most dejected appearance, and others lying down. The pulse was considerably accelerated, and scarcely perceptible at the maxillary artery, but at the heart it gave to the hand a jerking sensation: the skin was hot, red, and elevated in patches in the form of nodules or papulæ, approximated to each other. The chief seat of the eruption was on the inside of the

arms and thighs, on the sides of the face, the labia of the female and the *præputium* of the male, parts which are either nude or covered only with hair; but, on separating the wool, the whole of the skin was seen to be similarly affected, although less intensely.

In the *second* stage greater debility and emaciation existed: the discharge from the Schneiderian membrane was increased, viscid, and adherent to the alæ of the nostrils, impeding the respiration; the capillaries of the eyelids were in a highly congested state; the pulse was indistinct even at the heart; the ears and feet were cold; and the wool came off easily, shewing the skin underneath it inflamed, the redness existing principally between the elevations, although no distinct areola was present. The summits of the nodules were blanched, arising from effusion of a *very small quantity* of serous fluid beneath the cuticle, which scarcely gave to it the character of a true vesicle. All the papnlæ, however, had not taken on this change.

In the *third* stage the vital powers were prostrate; the fever had become of a typhoid character, the discharge from the nostrils fetid, and the other general symptoms much aggravated. The cuticle covering the majority of the nodules had assumed a brown colour, and pus here and there was formed on the *margins* of some of them, shewing the ulcerative state to have commenced: in others, simple desquamation of the cuticle had begun to take place.

In some extreme cases the ulceration had extended to the subcutaneous structure, and large unhealthy sores existed on the sides of the face, the inferior parts of the abdomen, the prepuce, and the inside of the thighs. I was at once struck with the resemblance of

this disease to small-pox in the human subject, and the identity of the two was further proved by the fatality of the affection in the febrile and third stages ; upwards of twenty sheep having already died, and others being in that state which precluded all hope of ultimate recovery.

The treatment recommended in the *first* stage consisted of a dose of laxative medicine at the onset, followed by the daily exhibition of mild diffusible stimulants, in conjunction with febrifuges ; such as the spirit of nitric ether, acetate of ammonia, and very small quantities of the antimonial compounds. After the acuteness of the attack had passed off, vegetable and mineral tonics conjoined were administered, as the compound tinctures of bark and gentian, and the sulphate of iron.

When there were symptoms of approaching ulceration of the cutis, a very dilute solution of the chloride of zinc was applied ; and the same was directed to be used when the ulcerative stage was established. Careful nursing, and generous and varied diet, were especially enjoined.

As prophylactic measures, isolation of the apparently healthy sheep was strictly enforced, with daily inspection, and instant removal of any in which the slightest indication of the affection manifested itself. The exhibition of aperients occasionally, the feeding of the animals on grass land where they could have access to water, and the placing of rock salt in their troughs, were also recommended.

Mr. Statham, at my request, kindly forwarded two sheep to the Royal Veterinary College, one being in the first, and the other in the third stage of the disease. That

in the first stage died shortly after its arrival, and thus afforded me an opportunity of ascertaining the lesions that had taken place. THE SKIN was thickly studded with the eruption in its papular or tuberculous form : many of the papulæ were distinct from each other, but the majority of them were confluent in large patches. A section of some of them being made, shewed that they extended to the subcutaneous structure, presenting an appearance not very dissimilar to that of warts. The cellular tissue immediately beneath the integument was infiltrated with blood ; the conjunctival and Schneiderian membranes were highly injected, as was the mucous lining of the trachea and bronchi ; and the vessels of the lungs were filled to engorgement, which evidently was the immediate cause of death. The other viscera, both of the thorax and abdomen, shewed no traces of unhealthy action.

The second sheep having been shewn to several medical friends, among whom was Mr. Erasmus Wilson, and the views taken by me of the nature of the malady being confirmed by them, a series of experiments was determined on, that we might ascertain in what particulars this disease agreed with human small-pox ; and also the best means to be adopted either to prevent its extension among sheep, or to mitigate its severity in those already attacked ; for we were fully convinced that serious consequences must follow, should the affection spread among our flocks, even if experience proved that other domesticated animals were not susceptible of it.

The outbreak in the above instance appeared to depend on the commingling of the Merino with the other sheep, and therefore we lost no time in making

such inquiries as would enable us to *trace* these sheep, with a view to satisfy ourselves with reference to the origin of the malady.

Difficulties generally attend investigations of this kind, and we are often unable to obtain sufficient information respecting the time of the introduction of a contagious disease; and the uncertainty is increased from the circumstance that very different laws are observed to govern the spread of epizoötics, many of which owe both their origin and their extension to a vitiated condition of the air, which, being wafted far and wide, carries destruction in its course; as we observed in the first Chapter. Such maladies as these break out in several places about the same time, and here and there animals fall victims to their devastating effects: in fact, no legislative enactments can prevent epidemics of this class entering a country, whether insular or not. Means, however, can easily be adopted to stop the course of contagion, and also of infection: the latter is well known to have its limits in many cases, and, as elsewhere explained, unless animals come within its sphere, or are placed near the infected, their health does not suffer.

All diseases possessing characters like those above named are not, however, of foreign origin; and it is a subject of regret that, within our "sea-girt isle," causes which might be modified, if not prevented, are far too frequently allowed to exert their injurious effects on our flocks and herds, and to give rise to endemic affections. Ovine pox belongs to foreign countries: the question of its infectious nature will be hereafter discussed, but its contagiousness is fully established by many proofs daily occurring.

Every encouragement being given to, and great faci-

lities existing for, the importation of foreign cattle and sheep, it was to be expected that contagious maladies would be introduced which had been hitherto confined to foreign climates. It behoves us to be silent on the alteration of the tariff, for we may differ in opinion, on this subject, from those who complain that the late visitations of destructive diseases upon our native breeds of cattle are the result of the importations above referred to. Some persons look to ordinary causes alone for the outbreak of an epizoötic, and therefore may regard ovine pox as having such an origin. Now the fact is undoubted that many thousands of foreign sheep have been imported, and disposed of in Smithfield market, within the last few years, and, until the time of the appearance of the disorder in question, no complaint has ever been heard respecting our introducing by such sheep a disease of any kind.\* This circumstance proves that confinement on board of ship has not operated very prejudicially to the health of these animals; nor has that cause produced the existing pest, for common causes are not found to produce *specific* maladies, as variolous affections must undoubtedly be regarded.

We have it from good authority, that the Marquis of Salisbury possesses upwards of 2000 Merino sheep, bought at various times, and not a single case of variola ovina has yet been seen among them. Mr. Wm. Eve, an extensive cattle salesman and occupier of land, has bought several hundreds of foreign sheep from different

\* The official account of the importations of sheep and lambs into England, from Jan. 1st to Nov. 27th, 1847, gives the total number of 133,618; out of which no less than 125,777 were disembarked at London.

importers. Some of these purchases have been made directly on the arrival of the sheep, and at all periods of the year; and he has kept the animals on every variety of food, but no cases of the disease have occurred in his flock. Were it necessary, we could mention many similar facts to support our opinion, that neither the sea voyage, temporary privation of food, excitement of over-driving, nor change of climate, management, or keep, has, separately or combined, been the cause of the malady.

That variola ovina has appeared in several places, and almost at the same time, cannot be denied: this was to be expected, and may easily be explained. In France and Germany, the best authorities agree in stating that the sheep in some localities, as in the neighbourhood of Paris, are seldom free from the affection: here, then, is one centre from which contagion may extend, and many similar centres may doubtless be found in the continental states: thus we have, in part, an explanation of the fact that every few years sheep-pox becomes more rife. We have been informed that in Hamburg market a separate place is assigned to sheep that shew any symptoms of contamination, or which are known to have come from a district where the disease exists; and we have reason to believe that a large proportion of the sheep exported from Hamburg to London are purchased of persons either in the market, or of farmers and others who reside within such a distance as to allow of the animals being shipped by cattle-dealers with but little delay. No surprise can therefore be felt at the circumstance that an affection which, although highly contagious, *lies dormant in the system for many days*, should find its way to this

country, or that the infected animals should be disposed of without a suspicion being entertained of the true state of their health.

We have ascertained that the fifty-six Merino sheep purchased by Mr. Statham were brought by the ship "Trident" from Tonningen, on the coast of Denmark. When disembarked they appeared to be in health, and were sold by the salesman to whom, with other sheep, they were consigned. We have not succeeded in tracing the subsequent distribution of each separate lot of this cargo, but we are assured that many of the animals still continue well. It is, therefore, evident that, in this particular instance, the malady was imported from Denmark, but this unfortunately did not prove to be a solitary case of its introduction.

Within a day or two of the arrival of the Trident, the "Mountaineer" and the "Princess Royal" came into port, each vessel having on board a number of Merino sheep brought from Hamburg. The whole number of sheep which arrived by the Princess Royal was 507, and these were exported by three different persons in the following proportions: 216 by A.; 200 by B.; and 91 by C.; so that the fact of some of these sheep having escaped the disease, is easily accounted for; as they, in all probability, came from different localities, and were free, when exported, from small-pox in its incubative stage, and were not exposed to infected animals at a time when the disease was communicable. Some of the 507 sheep above referred to were sold to the butchers; and others to farmers as "stock sheep;" the latter were bought, in several quantities, on the 26th of July, by Mr. B. Weall, of Woodhall, Pinner; Mr. Goodchild, of Kingsbury;

Mr. Pitman, of the same place; and Mr. Choke, of Barking: those purchased by the two last-named gentlemen are said to have continued in health ever since. Mr. Goodchild's sheep, however, shewed symptoms of the disease very shortly after arriving at his farm, their illness being attributed to his having had them dipped or washed; for its true nature was not suspected. That portion of the cargo of sheep of the Princess Royal which was purchased by Mr. Weall, consisted of 80 Merinos; and on the same day he bought 166 other sheep of the Merino breed that had arrived by the Mountaineer. These two lots were placed together, and, subsequently to being sent to Pinner, were equally divided between Mr. Weall and his brother. In each moiety the disease shewed itself, being first observed among the eighty sheep, about ten days after their purchase; and from them it rapidly extended to the others. Out of those belonging to Mr. B. Weall, twenty died in the acute stage of the malady; twenty-seven more were sacrificed; and the residue was disposed of at a low price, so that his loss probably amounted to about £50. The losses of Mr. J. Weall were, however, not so great.

We examined Mr. B. Weall's flock on the 7th of September, and found *two of the sheep* in the *earliest* stage of the malady; but most of them were recovering. We also saw, on one part of his farm, a quantity of Merinos which he had purchased about a fortnight before those which became affected, and no sheep could be doing better; they had been fed on the same kind of food as the others, and had made flesh very fast, and not a single case of ill-health of *any description* had been observed among them. These sheep had,

however, undergone a sea voyage during the heat of summer, and been sent to Smithfield, and indeed been subjected to the same ordinary causes of disease as those before spoken of. It is also worthy of remark that they were dipped, and thus exposed to that cause which was thought to have produced the malady in Mr. Goodchild's flock. Mr. Weall added his testimony to the observations we had frequently heard made by salesmen and others, to the effect that the Merinos appeared well calculated for "stock sheep," and were likely to prove a source of profit to the feeder.

An attentive and impartial consideration of all these facts will, we trust, give the true explanation of the outbreak of variola ovina in this country; and therefore we shall now proceed to describe certain experiments that we instituted to determine the special characters of this affection.

### *Experiment 1.*

On the 6th of September, a healthy Down sheep was placed in a shed for *twelve* hours with one of the affected Merinos sent by Mr. Statham, and afterwards was removed to a sufficient distance to preclude the possibility of the disease being subsequently communicated by infection. It was daily watched, and no appearance of indisposition presented itself until the morning of the 16th of September, when the animal was observed to refuse his food, to be dull and dispirited, and otherwise to manifest indications of febrile excitement. On examination of the skin on the inside of the thighs and arms, numerous red isolated patches of eruption were seen to exist; thus proving that the disease had been produced by contagion.

*Sept.* 17.—The redness of the integument is less perceptible to-day than yesterday, and the animal's general health remains nearly the same. Papulæ are forming.

*Sept.* 18.—The papulæ have become more numerous, also more elevated, and of a deeper red colour.

*Sept.* 20.—Imperfectly formed vesicles cover the whole surface of many of the papulæ, giving them a blanched appearance. Some of the smaller vesicles are rounded at their summits, but the greater number are flat, with slightly raised margins, but no distinct areola surrounds them. The patient's health has improved, and the appetite is returning.

*Sept.* 21.—The cuticular covering of many of the less developed papulæ has assumed a brown colour, indicative of approaching desquamation; and a still greater number of these elevations have presented themselves on the inner part of the arms.

To-day the animal was seen by Mr. Ceely, of Aylesbury, who has given to the subject of vaccination much attention, and he at once recognised the variolous character of the disease. Being anxious to carry on some experiments with the ovine lymph, several points were charged by him from the vesicles.

*Sept.* 22.—Some of the papulæ are disappearing without passing through the several stages; others have their surfaces still covered with small vesicles. The cuticle is of a browner colour upon the earliest formed, being detached in scabs, but no *pus* is discoverable beneath it.

It should be here mentioned that Mr. Marson, Surgeon to the Small-Pox Hospital, who had taken a lively interest in this case, and watched its progress daily,

was enabled this morning to procure some lymph from the matured vesicles: this was reserved by him for future experiments.

*Sept. 23.*—A few of the scabs on the prepuce are of a still darker colour, and are surrounded by a whitish raised border, from which a small quantity of fluid resembling pus can be pressed.

*Sept. 24.*—The animal may be reported as approaching convalescence. The majority of the crusts have become detached, and the exposed surfaces present a healthy appearance.

The attack in this instance was the mildest we have yet seen; but the result has been perfectly satisfactory, and the deductions to be drawn from it are obvious, no interference whatever having been given to the progress of the disease throughout its various stages.

### *Experiments 2 and 3.*

*Sept. 13.*—An Irish sheep, in perfect health, was this day inoculated from one of Mr. Statham's sheep; for this purpose we used some cuticle the cells of which were charged with lymph, and which had been removed on the 7th inst. from the surface of the nodules in their second stage. A portion of it was inserted inside the fore arm and the ear, by puncturing the skin with a lancet, and separating it from the subcutaneous structure; the cuticle containing the virus being placed in the wound.

Another sheep was similarly inoculated; but in addition to the portions of epidermis, some *pus*, procured from an animal in which ulceration had taken place as a result of the malady, was also introduced underneath the true skin.

*Sept. 14.*—Inflammation, apparently of a common character, surrounds the incisions in both animals; the inflammatory action, however, is greater in the one where the pus was used.

*Sept. 15.*—The inflammation has increased in both, but particularly in the sheep inoculated with pus, the fore limb of which is swollen, hot and painful, associated with lameness, and some febrile action has been set up in the system. Matter is beginning to form in all the incisions.

*Sept. 16.*—The suppurative action has become fully established; it has every appearance of being the result of ordinary inflammation. Both the animals feed well.

*Sept. 21.*—Since the last date, the wounds have freely discharged pus of a healthy character, and the sheep are now apparently free from any constitutional disease.

*Sept. 22.*—Both patients this morning are dull; they refuse food; keep themselves separate; lie down frequently; their heads droop; the ears are lopped; the countenance is anxious; the conjunctival membrane reddened; the pulse increased in frequency, and the breathing accelerated. An eruption has made its appearance on the inner side of the fore arms in each sheep: it presents the character of roseola variolosa.

*Sept. 23.*—The animal into which the pus was introduced suffers more than the other. The mucous lining of its nostrils is highly inflamed, and the secretion from it considerably increased, flowing over its lips; the pulse is much quickened; the respiration very short and painful; the conjunctiva inflamed, and tears trickle down the face; all food is refused, and the febrile ex-

citement is great ; but the eruptions are not more numerous than they were yesterday.

To facilitate our further description of these experiments, we shall name this patient, Sheep A ; the other, Sheep B.

#### SHEEP A.

*Sept. 24.*—Has rather less fever this morning, but the injection of the visible mucous membranes is greater than yesterday, and their secretions are augmented ; the sides of the face are also swollen ; the eruption continues unchanged in character, but there are fewer patches to be seen.

*Sept. 25.*—The eruption is principally confined to the hairless parts of the animal's body, and the inner side of its arms and thighs. The fever has increased in intensity.

*Sept. 26.*—Papulae can be seen here and there; the roseola is disappearing.

*Sept. 27.*—There is great increase in the severity of the symptoms, associated with prostration of strength ; the skin is hot, and the wool comes off easily ; the papulae or nodules are more elevated and extended. Sp. *Aether Nitr. et Liq. Amm. Acet.* were given, and ordered to be repeated daily. Careful nursing, and the administration of gruel, were prescribed for both patients.

*Sept. 28.*—This sheep still suffers more than the other, and the

#### SHEEP B.

*Sept. 24.*—Presents the same condition of skin : but the fever has abated somewhat in severity.

*Sept. 25.*—The integumental inflammation is more diffused ; the constitutional symptoms are mitigated, and the appetite returning.

*Sept. 26.*—The roseola is less visible ; no papulae can, however, be detected.

*Sept. 27.*—Papulae are present, and exist principally on the inside of the thighs, around the arms, and on the under surface of the tail. The constitutional symptoms are likewise aggravated.

*Sept. 28.*—The respiration is painful and laboured—33 in the minute ; the discharge from the conjunctival and Schneiderian membranes is of a mucous character, but free from any sanguineous hue ; the pulse varies from 108 to 112. At times the animal takes a little food, and does not lie down so much as the other sheep. The papulae, although existing all over the body, are distinct from each other.

*Sept. 29.*—The same symptoms continue, but they are increased in severity.

## SHEEP A.

fever has taken on the typhoid character; the eyelids are swollen so as to close over the eyes; the lachrymal secretion is thickened by an admixture of mucus, and runs down the cheeks; the muzzle and sides of the face are likewise swollen; a discharge of *sanguineous* mucus flows from the nostrils; the respirations number 44 in the minute, and are accompanied with painful moans; the breath and exhalations are fetid; the pulse is rapid and wavering; the poor animal takes but little notice, and is mostly found recumbent. Every part of the skin is studded with papulæ, which are becoming more confluent.

*Sept. 29.*—The patient died this morning. The *post-mortem* examination shewed the skin to be thickly covered with confluent papulæ, especially on the inferior parts of the abdomen, where they had formed large patches; the wool could be separated very easily from the cutaneous follicles; the exposed integument was of a dull-red colour; the subcutaneous structure was highly congested, more particularly beneath the larger collections of the papulæ; the mucous membrane of the re-

## SHEEP B.

*Sept. 30.*—On the whole this sheep is better, although the papulæ have increased in number and begun to take on the *confluent type*. (A lamb was this day confined in the shed with this patient, that we might satisfy ourselves respecting the time of the incubation of the malady, and whether this really differs in natural and inoculated cases, as was found in the preceding instances.)

*Oct. 1.*—The patient has experienced another relapse, and now presents a very dejected appearance: all food is refused; the breath is fetid; the respiration painful; and the pulse too feeble to be numbered with accuracy.

*Oct. 2.*—The fever has more the character of typhus than yesterday, and the vital powers are becoming exhausted. The papulæ are chiefly confluent, but, in some places, they are distinct; *no vesicles, however, are to be detected on any of them\**. The animal was seen by Dr. Gregory, Physician to the Small-Pox Hospital; by Mr. Ceely, of Aylesbury, and others; all of whom recognized the disease as ovine variola, and remarked on its great

\* PLATE No. 1 gives a correct representation of a portion of this animal's skin as it appeared this day: it shews both the papular and confluent type of the disease.

## SHEEP A.

spiratory system was inflamed throughout, presenting here and there, in the course of the trachea, accumulations of *viscid mucus of a dirty greenish hue*. On the lining membrane of the larynx there were *spots analogous to cutaneous nodules, but of a yellowish or blanched appearance, and placed upon a surface of deep Modena red*; the parenchyma of the lungs was infiltrated with blood; and the viscera of the abdomen shewed more or less of sanguineous engorgement. The fore extremity, which had been inoculated with the *pus*, was much inflamed and enlarged: lymph was effused into the cellular tissue, and other morbid alterations had taken place in the muscles, tendons, and ligaments.

## SHEEP B.

*similarity to small-pox in the human subject.*

*Oct. 3.—Death has put an end to the sufferings of this poor animal. The autopsy was made in the presence of Dr. Gregory, &c. The appearances on dissection vary but little from those which existed in the other sheep, but we give them at length, for the purpose of comparison. Externally, the skin is thickly beset with papulae; the subcutaneous areolar tissue is much engorged with blood; and on the borders of the lower jaw, the sides of the face and neck, especially just behind the ears, small accumulations of purulent fluid are present, occupying the central-internal portion of the confluent nodules. The Schneiderian membrane has many yellowish nodules situated on its dark red surface, being but slightly raised therefrom; similar spots are also observed on the mucous lining of the larynx, trachea, and bronchi. (See Plate 4.) The cavity of the thorax contains a small quantity of sero-sanguineous effusion; the lungs are congested, and the air-cells and tuhles filled with a dark frothy mucus. The viscera of the ahdomen are hut little altered; the general congestion of the vessels, which exists universally to a greater or less degree, has, however, changed their normal appearance.*

Several important inferences may be drawn from these two cases; but these we reserve for the sequel, and will only now remark that the experiments were undertaken with a view to ascertain, *first*, whether the disease could be propagated among sheep by inoculation; *secondly*, what the time of the incubation of the malady would be, if thus induced; *thirdly*, whether the epidermis, having its cells charged with lymph, could, when removed from the papulae, be depended on as a vehicle for inoculation; *fourthly*, if the constitutional derangement would be increased by a *small quantity of pus*, in addition to the lymph, being employed; and whether the danger to the animal would be rendered greater thereby; and, *lastly*, if *so rough* a method of operating could safely be adopted. The first three queries will be best answered by the experiments subsequently described; but with regard to the two latter, we may observe that it was important to arrive at a correct conclusion with reference to them with as little delay as possible; for, should the necessity arise for inoculation to be generally adopted in this country, to protect our sheep from the sad and often fatal consequences of an attack of small-pox, it would, in all probability, be found that farmers, shepherds, and uneducated cattle-doctors, would not hesitate to undertake the performance of it, and to continue their practice even though the lives of many valuable animals should be sacrificed thereby. Few men who have had experience of the way in which operations are performed on animals by such persons, will gainsay the assertion that their proceedings are alien to both humanity and science. We, therefore, hope we have proved, by the progress and virulence of the affection in the cases

recorded, and by the result, that great nicety is required as well in the selection of the fluid for ovination as in the manner of performing the operation ; two points on which the educated veterinary surgeon alone is capable of forming a correct judgment.

It will be seen that, early in the above cases, there existed a considerable amount of inflammatory action, accompanied with a discharge of pus from the inoculated places ; and that both the sheep suffered severely throughout the progress of the malady, and ultimately died from the fever of small-pox, which, during the continuance of the papular stage of that disease, is so often attended with a fatal result in the human subject. The fever, however, took on a more aggravated character in the sheep into whose system the pus was introduced ; a circumstance we were not surprised at, knowing that the absorption of this fluid, even when there is no reason to doubt its purity, is frequently attended with serious consequences.

We shall hereafter describe the means to be adopted to obtain the ovine lymph, and also the time when it is most to be depended on for inoculation : we therefore close this Chapter by remarking, that to secure success, and indeed safety, in the operation, lymph of a pure quality should be chosen, and deep punctures avoided in introducing it into the system.

## CHAPTER III.

OVINATION OF A SHEEP—REMARKS ON THE EXPERIMENT — CASE OF NATURAL VARIOLA — DISEASED SHEEP SOLD IN SMITHFIELD — COMMUNICATION AND INTERVIEW WITH THE BOARD OF TRADE — GOVERNMENT MEASURES — EXTRACT FROM “THE MARK LANE EXPRESS”—QUARANTINE, AND OBSERVATIONS ON IT—PROPHYLACTICS—LETTER FROM CAPT. J. S. CARR — SEIZURE OF VARIOLOUS SHEEP — POLICE REPORTS—EXPOSURE OF A HEIFER TO SHEEP-POX.

THE transmission of variola ovina, both by inoculation and by exposure of healthy to infected sheep, being proved by the cases described in the preceding Chapter, it was resolved to adopt a different method from that recorded, of introducing the ovine virus into the system; for we had to ascertain whether the death of the sheep, in Experiments 2 and 3, depended on the *plan* of inoculation, or on the matter used for that purpose: throughout the progress of the disease the patients' sufferings were so severe, and the fever which accompanied the variolous eruption was of such a character, as to make us very doubtful of their recovery, even from the commencement of their illness. That this febrile excitation was to be chiefly referred to the matter employed for ovination will, doubtless, be admitted; yet we resolved to test this by experiment, to satisfy ourselves fully upon the point. It was important to decide on the true cause of these unfavourable

results, and also to prove whether the inoculation of sheep would be attended by the same danger when the operation was performed on proper surgical principles. Without loss of time, therefore, we had recourse to the following

#### *Experiment 4.*

*Sept. 21.*—A healthy sheep was selected for ovination, and, at the suggestion of Mr. Ceely, several *scratches* were made through the epidermis, on the inner side of the fore leg: these slight incisions were arranged in groups, distinct from each other, and on them some dry but transparent lymph, which had been taken five days before from one of Mr. Statham's sheep, at Datchett, was rubbed, which, however, was first moistened with a little water. The limb was kept extended afterwards, until the exuded blood had become dry.

*Sept. 22.*—The skin is inflamed and raised in a fold extending a short distance from the places of inoculation towards the front of the leg.

*Sept. 23.*—The swelling and redness of the integument are diminished; the cuticle covering the scratched surfaces is raised by fluid effused beneath it.

*Sept. 24.*—There are, on the ovinated places, distinct pustules, coloured yellow by the secretion they contain.

*Sept. 25.*—The pustules have become of a darker hue, which depends partly on a drying up of their contents, and partly on the approaching desquamation of the epidermis.

*Sept. 27.*—Many of the scabs have fallen off, and the exposed sores have a healthy appearance.

*Oct. 2.*—A slight inflammatory blush is the only trace of the inoculation. The effects have been simply local, and the animal's general health seems not to have suffered throughout the progress of the changes produced by the operation.

In this case we have evidence that, when the local inflammation is accompanied with the early formation of vesicles or pustules, such a circumstance is to be regarded as unfavourable to the success of ovination. Many of the failures of vaccination in the human subject may probably be attributed to the same cause; for it appears that if *the lymph quickly excites* inflammatory action in the vessels of the papulated surface of the dermis, it is likely to become mingled with the exudations which fill the vesicles that are produced by such inflammation; and, consequently, it is thrown off, either by the immediate bursting of these vesicles, or by the drying up of their contents, and their subsequent rejection with the cuticle in the form of a scab.

Although the positive conveyance of the lymph into the circulation within a short space of time after it is placed under the epidermis may not be absolutely necessary to produce, *first, its local and ultimately its constitutional effects*, still the *corded* state of the absorbents which follows a successful ovination proves that it has caused a morbid condition of those vessels; and this is accompanied by a peculiar inflammatory action of the part, ending in the exudation of a fluid that has the same properties as that employed in the operation. It therefore appears that the virus or fluid used for ovine inoculation should excite its *more immediate and irritative effects on the lymphatics*, and not

on the capillaries, for us to be satisfied that variola will follow its introduction.

Several causes for the non-success of the case may be assigned besides that alluded to; and among them may be mentioned the small quantity of the lymph we employed; also its age (for it was kept several days) might have deteriorated it; and even its original *purity* may be reasonably doubted, as it was the produce of *very large* eruptive vesicles. We would likewise direct attention to the state of the system of the sheep at the particular period it was experimented on, as a reason why it was not susceptible of the action of the virus, for we subsequently succeeded in ovinating the same animal.

Whatever cause, or combination of causes, produced the failure of the experiment, the result, nevertheless, is not without its value.

We shall now proceed to a description of the case of THE LAMB mentioned at page 32, as being exposed to the contagion of variola by confinement in a shed with a sheep which was rapidly sinking from the malady. The two animals were kept together for eighteen hours, and no apparent ill-effect resulted until October 14th, *eleven days after the exposure*, when the lamb was found to refuse its food, and to give other indications of disease: the pulse was quickened; the breathing laboured and painful; the mouth hot; the ears pendent; the conjunctival membranes injected; an augmented lachrymal secretion also existed; the skin was generally reddened, and on the lower lip three papulæ were observed, and one at the angle of the mouth on the right side: no others were to be found on any part of the body.

*Oct.* 15.—With the exception of two small papulæ having appeared on *the brisket*, there is but little change in either the general or local symptoms.

*Oct.* 16.—The fever is less, and the patient feeds a little.

*Oct.* 17.—The skin at the corner of the mouth is cracked, and the sore looks unhealthy. Vesicles have formed on the papulæ on the lip, but those on the brisket are unaltered.

*Oct.* 19.—The vesicles have accidentally been broken, and brownish scabs cover the sores. There is ulceration of the skin, with a tendency to spread at the angle of the mouth. The patient's general health is much improved.

*Oct.* 23.—Every day since the last report the ulcer has been dressed with diluted chloride of zinc; and healthy granulations are beginning to form.

*Oct.* 25.—The animal may be reported convalescent. The papulæ on the brisket have disappeared without proceeding to vesication.

This proved to be another instance of natural variola ovina, assuming a mild form; a fact, perhaps, to be accounted for by the shortness of the time this animal, as also the subject of our first experiment, was allowed to remain with an infected sheep. The daily progress of the disease was watched with more than ordinary anxiety; for as yet we had succeeded only in one instance in procuring fluid from the eruptive vesicles of a sheep in which the constitutional and local symptoms of variola were not aggravated; and it is from such cases that the lymph should be selected for ovination. We regret, therefore, that the accidental rupture of the vesicles on the second day of their formation

should have rendered it necessary for other experiments to be adopted even for this purpose alone; as the circumstance retarded for a time our obtaining that amount of practical knowledge on the subject of ovination which we were desirous to possess.

While these experiments were being instituted we availed ourselves of every opportunity of acquiring further information, and frequently visited Datchett and other places where variola had broken out; and thus investigated the progress and the symptoms of the disease on the farms of different agriculturists. On each succeeding market-day we inspected the sheep at Smithfield, and made inquiries of salesmen and others respecting the general health of their stock; and we learned that occasionally, since the middle of the month of August last, many English sheep affected with the small-pox had been sold to the low class butchers of the metropolis. We also found that, early on Monday, September 13th, a large number of such sheep were thus disposed of; and although we were able to trace them, we did not succeed in getting a sight even of their skins.

On Friday, September 24th, we saw in the market two or three *pens* of infected Downs: they were surrounded by other sheep, and, not being sold at the latter part of the day, they had been the means of facilitating the extension of the malady to healthy animals, as the latter had been exposed to contagion for as long a time as we had proved, by experiment, would be sufficient to communicate the disorder. Nor were such instances confined to Smithfield; for at a market weekly held at Southall, in Middlesex, at which

both fat and *store* cattle are sold, many variolous sheep were often to be seen.

The necessity for the adoption of some means to prevent the free intercourse of healthy with unhealthy animals, and thus to get rid of one source from whence sheep-pox would spread, determined us at once to put the Government in possession of a knowledge of these facts; and a letter was forwarded to the authorities at the Board of Trade, stating that a malady similar to small-pox in the human subject had of late attacked the sheep of this country, and destroyed a considerable number in every flock where it had appeared; that it was very contagious, and would spread far and wide unless isolation of the diseased animals was enforced; a necessity for which was shewn by the circumstance that infected sheep were often exposed for sale in Smithfield market. We also added, that, from the information we had received, there could be no doubt the affection was introduced by certain Merino sheep exported from Tonningen and Hamburgh.

The Government promptly attended to this communication, and an interview with the authorities of the Boards of Trade and Customs took place, at which Dr. Southwood Smith and Professor Sewell also attended; various prophylactic measures were proposed and discussed; but some of the most effectual of them were abandoned, in consequence of the practical difficulties which would interfere with their adoption.

At this meeting, however, a more careful examination of all imported sheep by veterinary surgeons, duly appointed as inspectors, was determined on, so as to preclude any animals in a *positive state of disease* being

landed. For the particulars of the instructions which were issued, we beg to direct attention to the following notice, extracted from *The Times* :—

“ FOREIGN CATTLE.—With reference to the general orders issued by the Board of Customs to the officers of the department in the month of February 1845, directing their attention to the state of the cattle imported, in consequence of a certain disease then raging among cattle on the continent, the commissioners have caused the principals of the department in London, and the collectors and comptrollers of the Customs at the several outports of the kingdom, to be made acquainted that information has been officially received of the prevalence of an infectious disorder among sheep in several parts of the continent, and have directed that they will give instructions to the officers under their survey carefully to examine all sheep and cattle which may be imported into their respective ports from the continental states of Europe, and that, in the event of their appearing to be infected with any disorder, they are not to permit them to be landed from the importing vessel without an inspection as to their soundness by some competent person, and to report the circumstances forthwith to the commissioners for their direction. Allusion is especially made in this order to two of a similar character issued in the month of February 1845, on the subject. As the matter is of great public interest and importance, it may be stated, that the first consisted of a communication to the Board of Customs from the Secretary of the Treasury, stating that he had been commanded by their lordships to inform them that intelligence had been received from various quarters of the prevalence of an infectious disorder among cattle in several parts of the continent, and to desire them to give instructions to their officers carefully to examine any cattle imported into this country, and in the event of their appearing to be infected with any disorder, not to permit them to be landed without inspection, and report as to their soundness by some competent person, the circumstances being forthwith reported to the Board; the second, informing the officers of the department throughout the kingdom that the Lords of the Treasury having, through their secretary, Mr. Trcvelyan, with reference to the instructions already conveyed to the Board of Customs on the subject of a certain disease raging among cattle on the continent, desired that the Board would enjoin upon all their officers the greatest attention to the state of the cattle imported,

they (the officers) were to be apprised of this communication, and enjoined to a strict attention to the matter, with reference to the previous order of the Government on the subject, taking care not to fail to represent to the Board any matter that should arise fit for their cognizance. It will be seen that the present order is similar to those issued in 1845 on the subject, and will, as on that occasion, require an official inspection of all cattle imported by a veterinary surgeon on the part of the Crown, previously to their delivery and admission for home consumption, which shall appear to be in a diseased state."

If we investigate the laws that govern the extension of variolous affections, and to which sheep-pox offers no exception, it will be evident that the above order is not calculated to afford that amount of security to our native flocks which is required; for sheep in whose systems the disease lies dormant, will give no evidence of its incubation, and consequently it will elude the scrutiny of the inspector; and as the subsequent disposal of the imported animals is left altogether free, so infected sheep may find their way to various localities, and be mixed with our own breeds; and that outbreak which has happened will thus occur again and again.

We can but regret the inefficiency of these preventive measures; but, while we thus give utterance to our opinions, we are quite certain that, should the necessity arise, the Government will act with promptness in all cases of emergency, and immediately adopt the most stringent measures to prevent the spread of this fatal malady. On this subject, the talented writer of the "*Monthly Review of the Cattle Trade*" in the *Mark Lane Express*,\* and also in the *Farmer's Magazine*, thus expresses himself:—

\* No. 831, November 29, 1847.

"It is gratifying to observe that, at length, a stop has been put (owing, chiefly, to the stringent orders issued by the Government to the various officials in London and the outports) to the introduction of diseased foreign sheep into this country from Holland and Germany; still we are in no way satisfied that future importations may not be productive of the same disastrous results as those we have alluded to in preceding *Reviews*. For what guarantee have we that the disease will not be received here in its incipient state, and be communicated to those English sheep which may come in contact with the importations? The difficulties (arising from their want of condition) which have arisen in finding purchasers for the foreign sheep, have not unfrequently caused numbers of them to be turned out of Smithfield on several successive market-days; and, as a consequence, they are sent into lairs in the neighbourhood of the metropolis, and are mixed with the English breeds, which, as a matter of course, thus run the risk of contamination, and their owners of being considerable losers. Not a few of the cargoes from Holland which arrive hither on Tuesdays, Wednesdays, and Thursdays, are sent into Essex and Surrey to wait till the next market-day: hence it is obvious that existing arrangements are not calculated to prevent a recurrence of the evil. In our judgment, therefore, it should be made imperative, either that the sheep and beasts should be made to perform *quarantine*, or that they should be slaughtered immediately on being landed. As they look as well dead as alive, no possible injury could be inflicted on private interests by the compulsory adoption of the latter alternative."

To the greater part of these pointed observations we readily assent; but there is one to which many objections can be raised, namely, to the establishment of a *quarantine*; and as we consider that the adoption of such a plan would be injurious rather than otherwise, we will give our reasons for this opinion.

We presume that a *quarantine* must be general, and not partial in its operation; that is to say, that all imported sheep, at least during the existence of an infectious disease in the locality from which they came, are to be subjected to it. Let us take a view of the

system which exists with reference to the exportation of foreign sheep, and we shall find that cattle-dealers on the continent are the chief persons who consign them to English salesmen. A ship's cargo may, therefore, be the property of three, four, or five individuals; and the animals composing it being bought in different neighbourhoods by A, B, C, and D, some of them may, and others may not, have been subjected to the contagion of variola before they were put on board. While on their passage the chances are in favour of their not taking the disease, since no exporter would be so regardless of his own interests as to ship animals which were visibly suffering from it. Now, the sheep are disembarked, and go into quarantine, and the malady breaks out in A's lot, and all the others are instantly placed in a position to be exposed to the infection, and many will undoubtedly take it. What recompense, then, can be made to B, C, or D, and who is to sustain the loss under such circumstances? It may be replied that no necessity exists to herd the animals together. But we ask, where are there places, far enough removed from each other, to be found for putting each separate lot of sheep, and keeping them apart? As they continue to arrive daily, their number will amount to some thousands in the course of a fortnight; and for this period, at any rate, they must be under quarantine. The recent publication of the official returns for 1847 enables us to state that 146,698 foreign sheep have been imported into England during the year; and that, out of these, 138,739 have entered the port of London, being an average of 2668 per week. Who is to undertake to supply, and who to pay for, the food which will be consumed? In com-

mon justice, the person who sends healthy sheep, and who, but for this regulation, would have had them *turned into money* long before the time they are allowed to be sent into the market, cannot be called on for the payment of any portion of the sum thus expended. Let us also bear in mind, that animals exported from one climate to another are found for a time to lose condition, and thus their value may be lessened. While in quarantine they must be frequently, nay, daily, examined ; this, therefore, will necessarily be attended with considerable trouble and expense ; and if any diseased ones are found, all the sheep with which they were placed must either be kept *an indefinite time* or be slaughtered forthwith, and considerable loss will be thereby incurred : the pens, sheds, or places must also be purified by disinfectants before any *fresh* sheep can be allowed with safety to inhabit them.

These and many other practical difficulties must prevent the adoption of quarantine, which, indeed, to our mind, gives the idea that these selected spots will rarely be free from the disease. Here, therefore, would be a centre from which the sheep-pox might diverge whenever those mysterious but certain causes are combined which would produce its extension as an epizoötic.

Hurtrel d'Arboval, in his *Dictionnaire de Médecine Vétérinaire*, states that the clavelée is both epizoötic, enzoötic, and contagious ; and that, in the year 1816, considerable numbers of sheep were destroyed by it, particularly in the environs of Paris\*. The fact of that locality being rarely free from the pest has been alluded to, and an explanation of it is afforded by the

\* Articles *Clavelée*, *Clavelisation*.

circumstance that sheep are always congregated here to supply the markets of the city.

Some efficient means to limit the extension of contagion, in the event of variolous sheep being imported, should immediately be adopted, in order that we may be prepared for any emergency. It appears that our Government would have much difficulty in establishing a prophylactic system on the continent, even if that would give the required security to the flocks of this country, which, in the opinion of Captain Stanley Carr, it would not; for, writing from the *Duchy of Lauenburg*, he says, that—

“ Precautionary measures on this side of the North Sea, for ascertaining the soundness of sheep about to be shipped, could scarcely be enforced, since incipient taint may exist, and yet no symptom appear till drawn forth by the warmth of the hold. *The sanitary cordon must therefore be drawn in England, if anywhere;* and it might perhaps be advisable to appoint competent persons at all seaports to which sheep are imported, to examine the animals on landing, and empowered, when suspicious symptoms appear in any one of a flock, to subject the whole to a week's quarantine, during which the existence or non-existence of the sheep-pox among them must be evidenced\*.”

Variola ovina differs so much from any other eruptive malady, that we cannot agree with this proposition of putting suspicious cases under such restriction: some of our objections are similar to those already advanced; nay, a quarantine of this kind, and under such circumstances, would be useless. The author does not appear to consider the system very beneficial, for at page 7 of his treatise, speaking of an outbreak of the scourge, he observes, that “the only hope of saving those less

\* “*The Sheep Pox,*” by J. Stanley Carr, Esq. London, 1847.

affected, is at once to kill the leprous sheep—thus freeing the others from their pestiferous exhalations—and to bury the carcasses, wool and all, in some far-isolated spot."

Other preventives have been proposed, and among the rest, "*that of killing all the foreign sheep directly on their arrival.*" It will be seen at page 45, in the article we have selected from the *Mark Lane Express*, that the reviewer of the Cattle Trade suggests this measure, and adds—"as they look as well dead as alive, no possible injury could be inflicted on private interests by the compulsory adoption of the latter alternative." Now to this project we cannot consent, as a positive loss of food to the people of this country is thereby perpetuated; for frequently the low condition of the animals is such that the butchers will not purchase them, and consequently they are turned out of the market unsold. Why should our graziers be prevented from fattening these foreign sheep, when they can do so with profit to themselves and advantage to the community? Is it not a fact that, since the alteration of the tariff, thousands of Merinos have been fattened in England, and afterwards sold at a remunerating price? We see no objection to this system being continued, if our flocks can be rendered secure against an outbreak of any contagious pest; and this, surely, might be accomplished. Would the rights of property be respected if the above scheme were carried out? No. The value of the animals, be it what it may, would be lessened, and their general want of flesh would further assist the depreciation; for if the butcher can, at all times, be certain of procuring a supply of this kind of meat, will he not take care to have it at his own price? These carcasses

would thus be *a drug* on the market, as they must be disposed of at any rate.

The slaughtering plan might be adopted, were it wise to make an attempt to stop entirely the supplies of imported cattle; or if we were desirous of being—what indeed we never can be—altogether independent of foreign productions.

That a project to meet the exigencies of the case could be devised, admits of no doubt; and with a view to assist those who will devote their attention to the perfecting of one having the necessary requirements, the following outline is offered:—

We suggest—

That VETERINARY SURGEONS be appointed INSPECTORS at all the ports where sheep are landed, who shall examine the animals before they are removed from the ships; and in the event of any being affected with variola, shall see that the whole of the cargo is slaughtered immediately.

That all the *sound* sheep which had thus been exposed to the contagion during the passage shall be sent to the dead-meat markets; but that the carcasses of the diseased shall be buried, and their skins burnt.

That the losses sustained in consequence thereof shall be borne by the importers; as thereby, to protect their own interests, they will endeavour to prevent unhealthy animals being put on board.

That a market set apart for the sale of foreign sheep and cattle, and to be holden weekly, shall be established at each place of importation, to which all the animals that had passed the scrutiny of the inspectors shall be sent; and that under no circumstances shall our native breeds be allowed to enter it for sale.

That all the sheep arriving in the intervals between the market-days, and all those turned out unsold, shall be placed in lairs especially provided for their reception, and at a distance sufficient to preclude their being mingled with our sheep.

That printed forms be issued to the salesmen, which they shall deliver to the purchasers of any number of the animals, directing the butchers to kill those bought by them without any unnecessary delay ; and pointing out to farmers and others the absolute necessity of completely isolating the sheep for three weeks after they arrive on their premises ; recommending also an examination of them now and then during that period.

That if the disease should break out notwithstanding the adoption of these precautionary means, the person whose flock is affected shall send a report of the circumstance either to the Board of Trade or to some officer appointed to investigate the matter, so that immediate steps may be taken to confine the disease to the farm or place, and to lessen its fatality among the animals.

We are well aware that this scheme is open to objections : it is not, however, put forth to be acted upon without modification, but to arouse attention to the importance of doing something to preserve our flocks from this dreadful scourge, seeing the imminent danger to which they are daily exposed.

Direct contact is not necessary to communicate variola ; and of this a proof occurred on the farm of Mr. J. Weall, where a lamb became affected in consequence of being handled by the shepherd, who at that time had the care of some diseased Merinos. Several “ contagious maladies are known to pass from person to person,

from persons to goods, and from goods again to persons." The great end, therefore, of all sanitary laws should be not only to prevent the introduction of any pest of this kind, but, by separation, isolation, and restriction, to avoid its extension among either men or animals.

Some persons have asked, whether an Order in Council prohibiting the importation would not be the best step to take? To this we will only reply, that such an order can only be issued for a time, and could therefore give no security when the date fixed for its continuance had expired; and during the period when it was in force, the price of mutton would rise and injure the consumer, more especially the poor, for whom the paternal care of Government is particularly demanded.

On referring to page 41 it will be seen, that on September 13th and 24th, many infected sheep were sent to Smithfield. Some idea may be formed of the extent of the ovine variola at that time in the neighbourhood of London, from the fact that, on each succeeding market-day large numbers of sheep of various breeds, and in different stages of the malady, were offered for sale. The risk thus incurred of the rapid extension of the disorder was fearfully increased; for, as we have elsewhere shewn, many farmers, of late, have purchased their *stock sheep* at Smithfield; and, consequently, the quantity weekly penned gives but an imperfect notion of the supply of meat for consumption: hence, one reason why the price of mutton has not been this year in proportion to the sheep on which the market-toll has been paid. The animals purchased for feeding are forwarded by the different railways to the

several counties of England, and thus from London the contagion may radiate far and wide.

It cannot be said that these hazardous proceedings were continued for want of information, as the daily journals frequently contained letters relating to the subject, and we had taken care, from the first, to keep the matter before the public, and to point out the imminent danger of allowing healthy sheep to be brought in contact with diseased. To what extent the mischief might have gone cannot be surmised; but it is clear that thousands of animals would have been sacrificed had not the vigilance of the Government and the city authorities put a stop to it.

To corroborate the statement, that the attention of the public was called to the existence of the malady, we will here give a letter, written to the editor of the *Mark Lane Express*, by Captain J. S. Carr, Honorary Member of the Royal Agricultural Society of England.

“ TO THE EDITOR OF ‘THE MARK-LANE EXPRESS.’

“ Sir,—I observe with regret, in your journal of the 27th ult., a statement of the distressing fact that the sheep-pox has been brought by some recent importation from Hamburgh to London; and as I believe this alarming disease to be hitherto unknown in the British islands, I hasten to avail myself of your valuable and widely-circulating paper to give my friends, the farmers of England, a short description of the disease and its prevention; and shall also submit to the Council of the Royal Agricultural Society all possible further information by the next mail.

“ The sheep-pox appears occasionally in different and widely-separated localities on the continent. It is highly infectious, although not thought to be epidemic. There are four stages of this disease, which commences with loss of appetite, swelled eyelids, dulness, and a staggering gait, with slight fever. In three or four days small purple spots appear (easily discoverable where there is least wool, as

under the thighs and shoulders, and on the head), about one-eighth of an inch in diameter, surrounded by a red ring, and the centre flattened. The animal appears to be relieved when the pustule becomes developed, and if the attack be of a mild character, it soon recovers. But more frequently the pulse becomes quickened, the breath fetid, mouth dry and hot, eyelids and head swelled, so that the animal cannot be recognized, and soon falls a sacrifice to diarrhoea.

"The treatment, under such extreme circumstances, I recommend to be entrusted to an intelligent veterinary surgeon; but I advise all those who know of this frightful scourge being in their vicinity to have their sheep and lambs *inoculated* with virus taken from animals who have the disease in a *mild form*.

"About seven years ago I heard of its appearance in my neighbourhood, and had my own sheep and lambs immediately inoculated in the ear, in conformity with the suggestions of the Austrian Government in Bohemia, where this malady is longer known. I did not lose more than six per cent. of lambs and one per cent. of sheep, and the plan was equally successful with many of my tenants, who followed the advice; but in another village on this estate, where the contagion was allowed to take its course, there was, if I remember right, not a single sheep left! The subject is too important to be so condensed as to occupy a reasonable space in a newspaper. I propose, therefore, to publish a small pamphlet, containing all necessary information respecting it (with as little delay as possible), through Messrs. Partridge and Oakey, Paternoster-row, under the title of 'The Sheep-Pox, its Prevention and Cure.'

"I remain, Sir, your obedient, humble servant,

"J. STANLEY CARR."

"Duchy of Lauenburg, Oct. 12."

On the 1st of October the Government measures were determined on, and information was transmitted immediately to the Lord Mayor; and at the very next market-day, that is, on October the 4th, twenty sheep were seized by the police officers of Smithfield. A few days afterwards an application was made to the magistrate sitting at Guildhall with reference to these sheep, and the following report appeared in *The Times*.—

"**GUILDHALL.**—Sergeant Frederick White, the superintendent of the Smithfield police, reminded Mr. Alderman Musgrove of the detention of twenty sheep which were brought to Smithfield market on Monday last before they were free from the small-pox with which they had been recently attacked. The officer stated that he had since made further inquiry to ascertain whether the disease was likely to spread more over the country by permitting infected sheep to be brought into Smithfield. He found that it had already been a subject of inquiry at the Veterinary College.

"Mr. Alderman Musgrove asked if either of the twenty sheep had been the subject of examination?

"Sergeant White said, No. The experiments were made previously. One sheep was placed with an infected sheep for twelve hours, and then separated, and kept strictly apart from all other animals. It was not until nine days had elapsed that the sound sheep exhibited symptoms of the disease; two other sound sheep were inoculated, and the disease broke out in a much shorter time. The result of the investigation left no doubt on the minds of the veterinary surgeons that the disease was the true small-pox; that it was communicable by inoculation, and that it was highly contagious. The details were published in the *Veterinary Record*. Under these circumstances he wished to know if he should seize all the infected sheep brought to market?

"Mr. Alderman Musgrove said, it would be the officer's duty to report the fact to the magistrate who might be sitting, and take his directions respecting the sheep and the parties by whom they were sent."

The activity of the officers appears to have suppressed the sale of infected sheep, and also to have changed the tactics of those persons who endeavoured to clear their flocks of the pest, without regard to the way in which this was to be accomplished; for the animals were now slaughtered in the country, and then sent to the meat-markets of London. A circumstance of the kind was brought to our notice, in somewhat a singular manner. A gentleman wrote to say, that he had forwarded a sheep affected with variola to

a person in Newgate-market, with instructions that it was to be delivered to our order; accordingly a messenger was despatched to bring it in a cart, if necessary, to the College. In due time he returned, not, however, with a living sheep, but with a carcass, which had been properly dressed by a butcher, and which, notwithstanding the care taken to set it off to the best advantage, gave full evidence of the malady.

By the middle of October, this practice of getting rid of infected animals had so much increased, that the city authorities resolved on the adoption of measures calculated to prevent such unwholesome food being sold. The following report of the proceedings at Guildhall police-office, extracted from the *Morning Chronicle*, will best shew the notice that was taken of the matter :—

“ GUILDHALL.—When Mr. Alderman Musgrove took his seat on the bench this morning, Oct. 14th, he inquired if White, the sergeant of Smithfield-market, was in the court.

“ Roe, the officer, said he was not.

“ Mr. Alderman Musgrove: Because I have something to say to him in reference to the diseased sheep. It appears, that since I gave instructions to prohibit them from coming into the market, those sheep are now sent into the country, where they are slaughtered, and then brought into Newgate and Leadenhall-markets as dead sheep. If that be the case, it requires the vigilance of the officers to prevent any unwholesome food from being brought into the markets. When we are doing all we can to prevent diseased sheep from being sold alive in the market, we must not be defeated by the introduction of the same sheep dead. Has White any superintendence of the dead meat that is brought into the market?—The Clerk: No, sir.

“ Mr. Alderman Musgrove: There are, no doubt, persons in authority whose business it is to look after the dead-meat markets, and to take care that none of an unwholesome character is permitted to be sold to the public.

“ The Clerk: Yes, sir, the superintendents of the markets.

" Mr. Alderman Musgrove :—I should like to see them, that I might tell them to take care that no unwholesome food is allowed to be introduced into, or sold in, the market ; and if any thing of the kind were done, it would be my wish to punish the guilty parties."

The determination of the city magistrates, and the vigilance of their officers, did not entirely repress these injurious transactions ; for now and then, sheep which, by the number of the crusts on their faces and other parts, gave ample proof that they were severely affected with the small-pox, were sent to Smithfield market. The check given was, however, a salutary one, as, in the course of a few weeks no diseased animals could be seen, excepting those which had passed all danger, and which were not likely to be productive of mischief to others.

Experience having shewn the great susceptibility of the ovine race to take variola by contact, and oxen having such a free intercourse with infected sheep, we resolved to test, by a direct experiment, the danger incurred by the former ; and therefore made arrangements with Mr. Statham, of Datchett, for exposing a heifer on his farm to the contagion. Our thanks are due to that gentleman, and also to Mr. J. T. Stroud, of Windsor, for their kind assistance in this matter ; and as the result of the experiment and other particulars connected with it are so well explained by the communications which we received from them, we prefer the insertion of these to any other mode of description.

" Windsor, Sept. 29th, 1847.

" Dear Sir,—Mr. Statham has handed me your note of yesterday's date, and requested me to give you the particulars relative to the heifer, which, at your request, I sent to his farm, that she might be placed with his diseased sheep. The heifer was put, on the 23d inst., into the paddock where the worst cases are kept, and she has conti-

nued there up to this time. She is of the Irish breed, and about a year old, and was purchased, with some others, at Bristol, in August last. A few days after they came home the mouth and foot complaint [eczema epizoötica] shewed itself among them ; but from this they quickly recovered, and are now in perfect health, although rather low in condition. I saw this heifer yesterday, and could detect no appearances of ill-health. After she has been with the sheep a sufficient time for your present purpose, I should like you to have her at the College for any other experiments you may wish to have recourse to ; for I need scarcely say, that I am most anxious to avoid the possibility of such a disease as sheep-pox being conveyed to my farm. Believe me, dear Sir, truly yours,

“ JOHN THOMAS STROUD.”

Mr. Statham wrote as follows :

“ Datchett, Oct. 10th, 1847.

“ Dear Sir,—In reply to your inquiries, I beg to inform you, that the heifer does not shew any symptoms which would lead me to suppose that her health has suffered in the least degree from being placed with the infected sheep. When first put into the paddock she was closely penned with nearly *thirty sheep which were then affected with the small-pox in its most contagious stage*, and therefore I am of opinion that if it were communicable to other animals she must have taken it ; at all events, it seems impossible to have carried out the experiment in a more efficient way. Since you were here another of the Merinos has been attacked ; and as Mr. Ceely was most anxious to possess a sheep in the earliest stage of the disorder, I have forwarded it to Aylesbury. Is it not singular that this animal should have continued well so long, as it had been with the others from the first ? The forty-three Downs which were isolated are going on well ; these are all that have escaped the disease—I might say, all that are saved out of the flock ; for those which have survived the attack are so reduced in flesh and value, that they might almost as well have died. I am glad to see by the papers that the subject is taken up by the Government, and I do hope that the importation of foreign sheep will be prohibited, at least for a time ; for, depend upon it, if this disorder spreads, it will prove one of the greatest calamities that the agriculturists of this country ever sustained. Its effects are ruinous, and so contagious is it, that I shall fear to put any fresh sheep into the

pens and places where the diseased ones have lodged. Allow me to observe, that much credit is due to you for the steps you have taken in informing the authorities of the introduction of this fatal malady, and for the desire you evinced to investigate fully so important a subject. I am, dear Sir, your's truly,

"WILLIAM STATHAM."

The result of the experiment confirms the opinion of the French veterinary surgeons, that ovine-pox cannot be transmitted to the ox tribe by contagion or infection; as it will be seen by these communications, that the placing of the heifer for three weeks with variolous sheep was unattended with any injury to her health, and that, after her removal, she continued well.

Correct deductions can only be arrived at by repeated observations and well-devised experiments; and although a second case of the same kind of intercourse was also unattended with any ill consequences, still our opinion is to be considered as qualified, when we say that the small-pox of sheep will not spread to oxen through the medium of contagion.

We shall hereafter describe the results of the inoculation of these animals with the lymph taken from the vesicles of variola ovina.

## CHAPTER IV.

NATURE AND ORIGIN OF VARIOLA OVINA—ITS EPIZOÖTIC CHARACTER—DISEASE PRODUCED BY INFECTION—EXPERIMENT TO TEST ITS INFECTIOUS PROPERTIES—SUSCEPTIBILITY OF DIFFERENT SHEEP—NATURAL, INOCULATED, DISTINCT, AND CONFLUENT VARIOLA—INCUBATION—PAPULATION—VESICATION—SUPURATION—ULCERATION—DESQUAMATION—CONSTITUTIONAL SYMPTOMS—PER-CENTAGE OF DEATHS—TREATMENT, MEDICAL AND HYGIENIC.

HAVING, in the preceding portion of this treatise, made mention in a general way of many of the peculiarities of ovine-pox, we intend, in the following pages, to describe its nature and symptoms, and also the changes which take place in the tissues in consequence of its attack.

The disorder has so many points of similarity with the small-pox of the human subject, that we are enabled to adopt the definition of it which Mr. Erasmus Wilson gives in his work on “*Diseases of the Skin*.” That gentleman has introduced a new and highly scientific arrangement of these affections, in which small-pox is classed among the specific and congestive inflammations to which the dermoid covering is liable. The lesions caused by the malady are not, however, confined to the external parts of the frame; and therefore Mr. Wilson says that “variola is an acute inflammation of the tegumentary investment of the entire body, both cutaneous and mucous, associated with

fever of an infectious and contagious kind\*." This description may be considered as equally correct when applied to sheep-pox.

That variola does not shew precisely the same local effects in the sheep as in man, we admit, and, indeed, its progress and symptoms vary in the different domesticated animals; but these diversities are rather to be referred to the special arrangement and development of the component parts of the integument than to any real change in the nature of the malady. That these diverse appearances are but modifications of the same affection is further proved by the fact, that the causes which produce, and the laws which govern, the extension of small-pox, both in man and in the inferior creatures, are identical.

Varieties in structure produce varieties in function, both in health and disease; and although the uses of a part depend chiefly on its organism, may not these be modified or influenced by many other circumstances, such as the climate an animal inhabits, its food, temperament, and condition? Some creatures have their entire bodies covered with hair; others receive but a partial covering of it: some are clothed with wool, and others again with a mixture of both these products of the skin. Some are flesh-eaters; others feed on vegetables; while there are those which subsist on both. Some inhabit warm and dry, others cold and humid localities. Some endure great privations at the same time that their physical powers are being heavily taxed; while others are kept in a state of rest, and largely supplied with different kinds of provender,

\* A Practical and Theoretical Treatise on Diseases of the Skin, p. 49. London, 1842.

in order that, in their turn, they may yield us food. Our surprise, therefore, is at the great similarity met with in the symptoms of an exanthematous disease attacking animals, and not at any slight variation observed in its development in different species.

Investigators of medical science have attempted to trace ovine pox to its origin; but whether they have succeeded in doing this in a satisfactory manner is very questionable. The affection is supposed by many to have arisen in Asia, and, like small-pox, to have extended thence to the continent of Europe. Hurtrel d'Arboval says, "it may be that the clavelée sprung from the same source as variola, there being so great an analogy between them. The Arab physicians, more especially Rhazes, were the first to give a complete description of the small-pox; but at the remote period at which they wrote, there were no enlightened and educated veterinary surgeons to observe and describe the clavelée; and, consequently, this disease might have committed extensive ravages among sheep long before its existence was suspected; this conjecture," he adds, "is somewhat supported by the opinion of M. Odoardi, chief physician of Udine, who states that the small-pox of man came from the small-pox in sheep. A still more doubtful opinion has been advanced with reference to the origin of the clavelée; it being asserted that it arose from an eruptive malady to which turkeys are subject, and that when these birds are thus affected it spreads from them to sheep. Some eminent medical authorities have supposed that both variola and vaccinia sprung from a disease to which horses are liable, called "waters in the legs" (*eaux aux jambes*). This hypothesis might lead us to suppose, as observed by

M. Voisin, that, if the contagion can possibly be transmitted from horses to men, it ought to be communicated with greater facility from horses to sheep. These suppositions offer a new field for investigation, which experiments might elucidate\*."

Ovine variola early attracted attention from its ravages as an epizoötic ; and many of these outbreaks are recorded. In our first Chapter we have described one which occurred at Modena in 1691 ; and another in Lower Hungary in 1712. This epizoötic form of the disease is also stated to have visited Picardy in 1746, and to have continued till 1792, destroying hundreds of sheep every year during that interval†. Rabelais and Joubert mention the existence of clavelée in France in the sixteenth century, since which period many parts of that country have witnessed great destruction among the flocks, particularly in 1816. Hurtrel d'Arboval affirms, that since it was first observed, it has been found to return as an epizoötic every ten or fifteen years ; and, according to Captain Carr's account, it is well known in Germany, where it often appears in different and widely separated localities. These facts, while they shew the absolute necessity for the adoption of vigorous measures to guard against similar outbreaks in England, establish also an important resemblance between ovine and human small-pox.

The experiments which are recorded in these pages, and likewise the rapid extension of the disorder among the flocks of this country, prove very satisfactorily its contagious nature ; it is, therefore, unnecessary to add

\* Dictionnaire de Médécine Vétérinaire, article *Clavelée*, vol. i, p. 451.

† See pp. 9 and 12.

another word on this point ; to confirm, however, the correctness of our definition of the malady, we shall now speak of its infectious properties.

One instance, in our own knowledge, in which infection was the probable cause of the attack, occurred on the premises of Mr. B. Weall, of Pinner. In the latter part of September this gentleman, having a number of variolous sheep, determined on administering medicine to them, and for convenience they were driven into *some covered pens which were littered with straw* : here they remained only a sufficient time for each sheep to be dosed, after which they were again turned into the pastures. This practice was daily continued till they began to recover. A few days subsequently to the discontinuance of the medicine some healthy sheep were confined in these pens, and shortly afterwards became affected. The following extract from a letter from Mr. Weall, jun., will explain the particulars :—“ The sheep,” says he, “ were placed in the pens for the purpose of being *marked*, and they remained there about an hour. *No symptom of illness was observed for nearly a fortnight, when many of the animals were attacked with the small-pox. They had never been near to the infected Merinos.*”

The opinion of all the continental authorities whose works we have perused is, that the malady is very infectious ; and they speak of the danger of driving a healthy flock on the same road which shortly before had been travelled over by diseased sheep. Mr. Youatt, in an article on clavelée, translated from the French, has observed that, “ if it broke out in a flock, it was almost sure to be communicated, sooner or later, to all that were within a few hundred yards of it. It might be

unknowingly conveyed, and probably was, by the butcher, the shepherd, the dog, the sheep merchant, or the medical attendant. It spread by means of the transport of the wool and the skins\*." Mr. Mayer, sen., veterinary surgeon, of Newcastle, in a paper published in *The Veterinarian*, uses nearly the same words as Mr. Youatt, and adds, that it is difficult to decide accurately at what precise period an infected animal would be incapable of propagating the disease, as it lurks so long amongst the wool†." In the month of October we were consulted with reference to variola ovina breaking out in a flock belonging to Mr. Wm. Barber, of Nursling, Southampton ; and in reply to our inquiries this gentleman said, that he could attribute its appearance to no other cause than infection. Many agriculturists whose sheep have suffered from the malady believe it to be communicable both by contagion and infection. Mr. Fielder, of Sparsholt, affirms that the latter cause produced it in some of his lambs ; and as his communication to *The Farmer's Magazine* contains many pointed remarks on the progress of the disorder in his flock, we will here insert it.

" On the 16th of August, 1847, being in Smithfield, I purchased 118 Spanish sheep. For nearly a month no sheep could go on better, with the exception of one, which never appeared healthy, but no cause for its illness shewed itself; I did not examine it at the time to see if any marks of the small-pox were on it, never having heard of such a disease in sheep. At about the end of three weeks, or nearly a month, it died ; and about that time I found some more of the Spanish sheep falter, and half a dozen of the Southdown lambs which were with them : the Spanish sheep having been put into a flock of 300 lambs of that description. They continued to get

\* Sheep ; their Breeds, Management, and Diseases. p. 541. London : 1837.

† *The Veterinarian*, p. 625, vol. xx.

worse, and several of them died daily. The disease shewed itself by a breaking out round the nostrils and the face, and the eyes of many were much affected, some completely blind ; large scales and pustules by the sides of the face, and all over their bodies. It shewed itself particularly between the shoulder and the brisket, when the sheep was turned up. It resembled the small-pox, and I have no doubt but that is the disease, it leaving in those that recovered pits in the face and on the skin wherever a pustule had been. Many of them had it so severely that in two or three days they could not eat, and were starved. Observing what I did, I gave to those which were very bad oatmeal-gruel several times a day, and saved many which must otherwise have died. *To shew how very infectious it is, I had 350 Southdown lambs in another flock, that never had been mixed with the Spaniards, or with any of the diseased lambs, and they broke out with it from having been penned by the side of the others in the same field while feeding off rape ; clearly shewing that the infection was carried in the air from one flock to the other\**. I am pleased to say, by taking a great deal of trouble, and by perseverance, I have every reason to suppose that I have effectually stopped this fatal disease from infecting the whole of my flock, being upwards of 700. I will merely state the course I took to arrest its progress after losing nearly half of those taken, losing between 50 and 60, in about three weeks, out of about 130 which broke out with it. I employed two men to turn every sheep I had on my farm, and minutely inspect every one of them ; and if they saw the slightest appearance of any rash, or a single pustule shewed itself between the inside of the shoulder and the hreast, where the skin of the sheep generally looks white and clean, and where it was sure to shew itself first, *I had it immediately taken away, putting the whole of the diseased ones together in one large field in the middle of my farm, a distance from any road, as a protection to my neighbours.* I followed the same course every morning, by having all my sheep turned and closely inspected, not looking at the trouble and expense, as I felt in my own mind that it was the only remedy I had to stop the infection ; as I calculated, if I could only find out those sheep which had taken the disease and were breeding it, before it became infectious to others, I should be able to arrest its progress. Fortunately, I was right in my calculations ; for they daily decreased in numbers, although they still kept faltering for a fortnight or three weeks from the time I began turning them (particularly in one flock, where the

\* The *Italics* in this extract are our own.

Spanish sheep had been), before it, as I hope, ceased altogether, as I have not found a diseased one for some time past. I had three Southdown wether sheep (two-toothed), which were the only sheep I had on my farm; the other part of my flock being lambs. I had the three sheep put in with the Spaniards when the Spaniards appeared healthy. All three were taken within a week, and in about four days two of them died, the other remaining very ill for some time; I therefore consider the older the sheep the more fatal will be the disease. I intended selling 300 of my lambs at Weyhill or at Winchester fair in October, leaving me my winter stock; but, fortunately for me, and for the public, the disease shewed itself before I sold one of them. I shall now keep the whole during the winter, having put them on cut swedes, giving them peas, maize, and hay; so that, through me, the disease shall not be carried into any other man's flock. And I do hope every individual who may have been so unfortunate (as I have been) as to have purchased any (and I hear several have), will use his utmost endeavours to put a stop to this most fatal disease in its infancy; for I feel, if this once extends itself to the flocks of this country, no man can tell the serious injury which the country may sustain, or where it will end: 20, 50, or 100,000 has nothing to do, in my opinion, with the loss that might be sustained in the flocks of this country if due precaution is not taken in putting a stop to it in its now first appearance.

I see they talk of having a person to examine the foreign sheep in Smithfield: that may be very well to prevent immediate infection; but I could have sold 500 there, within the last month, that had the disease amongst them, and 100 of them breeding it, having caught the disorder, when no man living could detect it in a single sheep.

\* \* \* \* \*

Many of my sheep will carry the marks and pits left by the malady on their bodies to the shambles, if that should be two or even three years hence.

“CHARLES FIELDER,

“Land Surveyor and Farmer.”

“*Sparsholt, near Winchester, Hants, Nov. 4.\**”

Early after ovine variola was imported into this country we placed healthy sheep with diseased, taking

\* The Farmer's Magazine, page 524, vol. xvi.

especial care, however, to guard against direct contact between the animals; this was done with a view to ascertain the possibility of the disorder propagating itself by infection alone. Our first experiment was undertaken at the suggestion of Dr. Southwood Smith, who was desirous to carry out a series of experiments in order to test both the infectious properties of the malady and the power various disinfectants might have in mitigating or preventing its spread. We did not succeed in this instance; but we insert the particulars.

On Oct. 3d, very shortly after the death of sheep B (see page 33), a healthy Down was confined in the shed, which was an enclosed one, where sheep A and B had been kept during their illness; a small quantity of the straw on which they had lain was left on the floor, but the walls and other parts were clean; and it will be seen, on reference to these cases, that both animals died in the papular stage of the disorder, consequently no matter existed in the place as a vehicle for contagion. The Down was kept in the shed for upwards of a fortnight, and was carefully watched both during that time and afterwards, but no ill-effects resulted; a fact which receives further confirmation from our success in inoculating the same animal at a subsequent period. Hurtrel d'Arboval states, that fever unaccompanied with an eruption on the skin is often the only result of exposure, and that its invasion affords an equal protection to the patient.

Notwithstanding this and other failures, it is our opinion, on reviewing all the circumstances connected with the increase of sheep-pox, both here and on the Continent, that *it is infectious*. The epizoötic cha-

racter of the disease is fully established, and this goes very far to prove its infectious nature, although many causes besides may be in operation to produce its extension, in that peculiar form.

It is generally admitted that, whenever variola is introduced among sheep, neither the locality they inhabit nor the system of their management or feeding, nor age, sex, or breed, gives security from an attack, or prevents the malady from spreading. But it has been noticed that some of the flock fall victims to the effects of the disorder much earlier than others, arising from their greater susceptibility to receive the poison. Young sheep seem to be the most prone to take it. The true why and wherefore of this phenomenon, or of other portions of the same flock resisting the attack for a longer period, cannot be satisfactorily explained.

According to the French authors, the early cases are mostly mild, and the subsequent ones severe, with the exception of the very last, when the disease is again less destructive. Our experience, however, does not confirm these statements.

Several well-marked instances of sheep remaining unaffected for a considerable period have come to our knowledge: *two* of these took place on the farm of Mr. J. Weall, *a month* having passed after the animals were first exposed to the contagion, by living with the diseased, before their health was affected. In Mr. Statham's letter (see page 58), a question is put to us on this subject; and it appears, by the date of his communication, that *two months* elapsed before the Merino to which he alludes shewed any symptoms of the malady, although it had remained with his in-

fected sheep from the commencement of their illness. These three animals were attacked with an aggravated form of the small-pox, which rendered their recovery very doubtful, and one of them died.

Variola ovina, like its prototype in man, is produced by two separate causes, exposure and inoculation : which circumstance has induced pathologists to divide the small-pox into *natural* and *inoculated*. Our experiments verify the propriety of this classification, but they do not establish the general opinion to be correct, that the former is more fatal than the latter ; this may, however, depend on the manner in which they were carried out, as in every instance when we attempted to propagate the disorder naturally, we limited the time of exposing the animals to the contagion, and subsequently kept them apart from the infected. The natural disease has been fearfully destructive in this country ; and further experience may prove that, of the two varieties, the inoculated is the least fatal.

The affection admits also of a division into *distinct* and *confluent* : in the former, the papulæ, although numerous, do not inosculate ; but in the latter they run together, and produce large accumulations on many parts of the skin. The danger to the patient being very much increased when confluent papulæ exist, has led several of the continental writers to call this kind the *malignant*, and the other the *mild* small-pox. Many reasons can be assigned for confluent variola being so fatal, besides the augmentation of the local effects observed during its progress. The malady, when it takes on this character, does not pass so regularly through its different stages ; vesication is delayed ; and until vesicles form on the papulæ, the variolous

fever rarely abates, and its continuance leads to its assuming a typhoid condition. The mucous membranes, both of the respiratory and digestive organs, participate in the morbid state of the skin, and the inflammation has a great tendency to end in sphacelus. A viscid mucous secretion adheres to the nasal openings, plugs them up, and often produces suffocation. Purulent formations take place in the subcutaneous cellular tissue, and uncontrollable diarrhoea is frequently associated with confluent variola. These are so many additional causes for its increased malignancy.

Many affections which attack both man and animals possess the singular property of remaining latent for a greater or shorter time after their respective poisons have been received into the system; hydrophobia, glanders, farcy, the small-pox, and several others, belong to this class. This *period of incubation* is found to vary in different diseases, and also in the same disease at different times: it is influenced by many external circumstances, as well as by the peculiar state of the patient's constitution,—such as the mode in which the poison is received, the heat of the weather, temperament of the animal, freedom from other complaints, &c. None of these causes can be said to prevent, although some of them will retard and others facilitate, the breaking out of the eruption.

Both in natural and inoculated small-pox the temperature has much to do with the early appearance of the constitutional symptoms, which declare themselves sooner in summer than in winter. Hurtrel d'Arboval remarks, that the malady will often shew itself in ten or twelve days in warm weather, but will remain dormant for double that time when the temperature is

very low. Girard states, that its incubation rarely exceeds six or eight days during the heat of summer. In our own experiments, the period has varied considerably: we have witnessed the appearance of the eruption on the seventh day succeeding inoculation, and we have known it to be delayed to the thirteenth day, although the experiments were being carried on simultaneously: in *natural* cases also, the time has ranged from the ninth to the twelfth day. The disease is generally found to be less destructive in cold than in warm and humid weather, and to produce a less amount of mischief among young animals than among old.

We have no practical deductions to record with reference to the progress of ovine variola when other febrile and eruptive maladies exist at the same time in the system; but as the lower animals cannot be said to offer an exception to the rules regulating the development and course of this disorder in man, we shall insert the observations of Mr. Marson, whose experience and judgment in these exanthematous affections rank very high. This gentleman says—

"It is rare to see two active diseases, such as small-pox and scarlet fever, affecting the body at the same time; as, indeed, it must be, to induce a man of Mr. Hunter's great experience and observation to believe that it never occurred, and to go so far as to state that no two diseases of this kind could go on in the body concurrently. These are his words:—'As I reckon every operation in the body an action, whether universal or partial, it appears to me beyond a doubt that no two actions can take place in the same constitution, nor in the same part, at one and the same time; the operations of the body are similar, in this respect, to actions or motions in common matter. It naturally results from this principle, that no two different fevers can exist in the same constitution, nor two local diseases in the same part, at the same time.' Again:—'In two eruptive diseases, where

both are necessarily the consequence of fever, and where both naturally appear after the fever nearly at the same distance of time, it would be impossible for the two to have their respective eruptions even in different parts, because it is impossible that the two preceding fevers should be co-existent.'"

Mr. Marson adds—

"Unquestionably the examples are but few in which two febrile diseases do occur at the same time in the same individual; but the rule is not without exception, nor any thing like it\*."

The incubative, or *first stage* of sheep-pox, will doubtless be modified by the system being affected by any similar disorder; but whether incubation proves to be long or otherwise, we find as a consequence of the animal having received the poison, that an eruption breaks out on many parts of the skin. This, which may be called the *second stage* of the malady, is recognized by the existence of *papulæ*, or *nodules deeply imbedded in the dermis*, having a florid red aspect, (*see plate 1*): these shew a preference for some parts of the integument, and are usually to be first detected on the inner side of the arms and thighs, and on the cheeks and lips, where the animal has a hairy and not a woolly covering. Other portions of the body are often simultaneously attacked: as the prepuce, labia, anus, and under surface of the tail,—parts which are perfectly nude.

The eruption quickly extends, in most cases, over the whole skin, manifesting itself either in a *distinct* or *confluent form*. But we have observed that Down sheep are especially prone to the formation of the papulæ on

\* An Essay on Variola and Scarlatina. *Transactions of the Medico-Chirurgical Society*, vol. xxx.

their faces, and that, under such circumstances, the malady proves highly destructive. The papulæ vary in size and number : they impart a firm unyielding sensation to the finger, and when cut into, present an appearance not very dissimilar to a section of a wart : their vascularity is not great, excepting on the surface, or rather on that part which is continuous with the vascular layer of the dermis.

The changes which produce these nodules evidently affect the corium, and probably are to be referred to two especial causes—a rapid development of the component parts of the skin, from the increased quantity of blood sent to it, and the inflammatory action which results, producing a deposition of lymph into the interstices of the corium. On forcibly detaching a little of the wool, the exposed nodules undergo a singular change ; for a few seconds they have a whitish appearance, which is followed by a return of their usual redness ;—a phenomenon which shews that their colour chiefly depends on the blood circulating through the capillaries of the papillated surface of the dermis, and not on an equal distribution of this fluid throughout their entire substance.

This stage of the disease is thus described by Sacco, an Italian author : “ The eruption of the sheep-pox,” says he, “ shews itself in the form of small red points, which gradually enlarge, and attain the figure and size of a lentil. In general the eruption of these pustules [papulæ?] is copious : they often unite one with the other, so as to produce in the skin prominences similar to a bunch of grapes. The greater part of these pustules [papulæ?], on being pressed upon by the finger, prove to be hard bodies, like small glands, and if they

are punctured, a resistance is found to the passage of the needle through them. Instead of a lymphatic humour exuding from the punctures, a drop of blood only escapes\*."

We have noticed in both natural and inoculated small-pox of the sheep a diffused redness of the integument occurring in patches of various size, and preceding for a day or two the formation of the papulæ. In inoculated cases this redness is frequently so well marked, that it constitutes a disease of the skin analogous to *roseola variolosa* of the human subject, and establishes another similarity between these maladies. A reference to our experiments 1, 2, and 3, will shew that it was present in each of these instances ; becoming less visible as the papulæ were developed, and subsiding altogether after they were perfected.

The duration of the papular stage of ovine variola is found to vary ; we have seen vesicles produced on the nodules on the *second* day of their appearance, and we have known *six* days to elapse without vesication taking place. We consider that, in the majority of instances, *three days may be regarded as the period of papulation* ; it being generally longer in confluent variola than in distinct. Hurtrel d'Arboval speaks of the occasional disappearance of the papulated eruption, and of its remaining dormant in the system for three weeks, and then breaking out†. Cases of this kind have not come to our knowledge, but we will not doubt the accuracy of such an authority.

Simultaneously with the first indications of the inte-

\* Trattato di Vaccinazione, del Dottore Luigi Sacco. Milano, 1809, p. 149.

† Article *Clavelée*.

gument being affected by roseola or papulae, the patient gives unequivocal signs of the febrile action set up in the system; refuses his food, and shews but little disposition to notice his companions or surrounding objects.

Many of the continental pathologists state, that symptoms of fever, which continue unabated for two or three days, precede the eruption on the body: our experience does not confirm this assertion; for we have never seen any indications of ill-health, or of the mucous membranes, either of the respiratory or digestive systems, being functionally deranged prior to the eruption; and we are of opinion that the morbid action commences at the same time both in the mucous membranes and the common integument.

The papular is succeeded by the vesicular stage of the disease, which is recognized by the elevations hitherto red, becoming white in colour (*see plate 2*). This change depends on three particular causes; first, the effusion of a limpid fluid by the capillaries of the papillated structure of the dermis; second, the partial imbibition of this fluid by the cells of the epidermis; third, the increase of the exudation separating the epidermis from the dermis. We have elsewhere spoken of the blanched appearance of the cuticle, and the imperfect development of vesicles; it is not, however, to be understood, that we mean by this description, that a portion only of the epidermoid covering of each nodule is raised, but that the elevation itself is slight, its size being co-extensive with that of the papula. A careful examination of the vesicles shews the cuticle to be thicker than natural, and the openings of the sebaceous, perspiratory, and wool follicles very conspicuous.

This augmentation in the substance of the *epidermoid reflections* is probably to be accounted for by the normal secretory functions of the dermis being increased during the formation of the papulæ; in consequence of a larger supply of blood being determined to it than under ordinary circumstances.

The rapid growth of cyto-blasts and epidermal cells will not only produce the increased thickness, but will cause much of the effused lymph resulting from the continued inflammation after the nodules are developed to be imbibed by these cells: hence the white aspect of the cuticle; for this cellular imbibition effects a change in the appearance of the epidermis, analogous to that which takes place on the hands of washer-women after long exposure to the action of water.

Many of the eruptive vesicles are so small that they will yield no lymph for inoculation, the whole of it being taken up by the epidermal cells; but when a larger quantity of the fluid exudes from the capillaries, then vesicles more or less distended are produced. In the perfectly formed and matured vesicles of the sheep we do not find the lymph contained in a reticulated structure, as in the vaccine vesicle of the human subject; one puncture, therefore, made in any part of the ovine vesicle is sufficient to evacuate its contents; but several are needed to effect the same thing in the vaccine vesicle. The modification of organism of the common integument of sheep, depending upon the surface of their bodies being chiefly covered with wool, may probably be a cause of this difference.

The duration of the vesicular as of the papular stage of variola ovina varies in different cases, and we frequently observe that all the papulæ are not

vesicated at the same time : this change comes on a day or two later in some than in others, while several will disappear in the course of the disease without vesicles being produced. Another circumstance worthy of note is, the non-existence of any areola in the early stages of vesication ; indeed, it is only when the vesicles are fully matured, and their contents are becoming purulent, that areolæ are seen ; and even then they are neither deep in colour, nor extensive.

The ovine vesicle is flat on the surface ; and in this particular it forms a contrast both with the vaccine vesicle of the cow and with the variolous of man : in the former disease it is found to rise in an acuminate shape from the papula, and in the latter to be umbilicated in the middle. The central depression occasionally exists in the perfectly developed vesicle of the sheep-pox, when a crust is formed on its middle ; but if the cuticle dries and produces a scab of the full size of the vesicles, then umbilication is not present.

In the progress to maturation, the contents of the vesicles undergo similar changes to those that are produced by ordinary causes : thus, at first they are distended by a clear and limpid fluid ; this soon becomes *opaline, or milky* ; *then turbid, less serous, and straw-coloured* ; and ultimately, by drying, hardens into a crust, and is cast off with the epidermis. This description of the changeable appearance of the vesicles agrees with the observations of Mr. Ceely, who, in a letter which we have received from him, gives a similar account of their progress : he also adds, that when he first saw the ovine crusts, he felt doubtful of the correctness of the term *pustule*, as applied to the eruption ; and has satisfied himself that it is not essentially a pustular

disease, but that it is *vesicular*. In common with Mr. Ceely, we have seen many sheep pass through an attack of small-pox without any *pustules* being formed; but in the latter stages of extreme or protracted cases a purulent fluid is secreted by the vessels of the inflamed dermis, which becomes mingled with the contents of the vesicles, and virtually changes them into pustules. When a large quantity of pus is produced, the *ulcerative process* usually follows, and extends more or less into the structure of the corium, and not unfrequently into the subcutaneous tissue. The simple transition, however, of a vesicle into a pustule is not necessarily attended with ulceration; for the suppurative action is often arrested, and dry brown scabs are then the result. Again, it will be observed that the inflammation runs so high when the papulæ are confluent, that death of the skin takes place in patches: these are frequently situated on the inferior parts of the abdomen, and inside of the fore and hind extremities. In such cases pus forms on the margins of the sphacelated integument directly below the scarf-skin, and absorption goes rapidly on to effect the removal of the slough. The ulcers thus produced discharge a vitiated fluid, more or less purulent, for many weeks, and have very little tendency to heal by granulation.

These remarks, we beg to state, are not made with a view to disprove Mr. Ceely's opinion, but to shew that there are circumstances under which the suppurative action may be set up in the progress of ovine variola. The formation of pustules, as we consider, ought to be regarded rather as an adventitious than an essential feature of the disease.

Soon after our experiments were begun, we made

microscopic examinations of the fluid contained in the vesicles, with a view to ascertain at what date pus became mingled with it. Mr. Ceely kindly furnished us with some tubes filled with fluid obtained in different states of the vesicle, and he thus writes on the subject : “ I am very desirous that you should notice the microscopic appearances of the contents of the vesicles at three periods ; 1st, when filled with clear ichor ; 2d, when opaline ; and, 3d, when turbid or straw-coloured. From what I have seen, I expect you will find *pus globules* in the third, if not in the second condition.” We will only add, that “ the milky” state of the fluid seems to depend on the presence of a large number of epithelial scales, and the yellow hue, on the mingling of pus globules ; both of which were readily detected with a sufficient magnifying power, and the latter underwent the usual changes on the addition of acetic acid and other re-agents.

Some of the French and Italian authors, in their descriptions of the eruption, make an erroneous use of the word pustule, and speak of nodules, *boutons*, and pustules, as if they were synonymous. This occurs in the works of Hurtrel d’Arboval, Sacco, and others, and is likely to mislead even the medical reader with reference to the true phases which the disorder presents.

The succeeding stage to the vesicular is that which produces a scab, and ends in the fall of the epidermoid covering of the papulæ. These changes are spoken of as the processes of *desiccation* and *desquamation*. The period of their completion depends on the extent of the original eruption, and also on its being *distinct* or *confluent* : it is likewise governed by the amount of inflam-

matory action which existed in the dermis, and is always protracted when suppuration has taken place.

The crusts vary from a brownish yellow to a black colour ; they likewise differ in thickness, being of greater substance when cast off from a pustule than when from a vesicle : a fact which is referrible to the dried pus being united with the desquamated cuticle. The *crustaceous stage* is accompanied with a subsidence of the eruption ; but many of the papulæ will be found vesicated when scabs are forming on others ; and some of them will have pale yellow crusts on their surfaces, produced by simple desquamation of the epidermis in the form of furfuraceous scales ; in such instances, as no vesicles are developed, the skin soon regains its normal condition.

The fall of the purulent scabs leaves pits of various sizes on the site of the original papulæ : the depth of these, and the time occupied in the process of cicatrization, are necessarily proportionate to the extent of the ulceration.

The great liability of the vesicles to receive injury, and of the crusts to be forcibly detached by the sheep scratching and rubbing themselves, interferes considerably both with the regularity of the progress and the local symptoms of the disease. Hence, when the eruption breaks out on the face, two or three weeks usually elapse before the healing of the sores is completed. The Frontispiece to this work gives a good representation of the production of scabs, as modified by the injuries alluded to.—*See plate.*

From the account here given of the several stages of ovine variola, it will be seen that considerable irregularity exists in its development, and also in the

period of its duration. In natural cases, even when mild, and when no cause retards their completion, a month, reckoning from the period at which the animal was first exposed to the contagion, usually passes before it is restored to health.

The following summary of the gradations of the malady may be accepted as sufficiently accurate for practical purposes :—The first ten or eleven days are those of *incubation*; the twelfth and thirteenth, of *invasion*; the fourteenth, fifteenth and sixteenth, of *papulation*; the seventeenth, eighteenth and nineteenth of *vesication*; the twentieth, twenty-first and twenty-second, of *suppuration*; and the twenty-third to the twenty-eighth, of *desiccation* and *separation* of the crusts.

Having described the local appearances, we shall now speak of the constitutional symptoms of the affection, and point out those which indicate the greatest danger to the patients. The infected sheep separate themselves from their fellows, and mostly lie down in a remote corner of the field: they exhibit a peculiar, dejected condition; the head is held low; the ears are pendent; the breathing is quick and short; the eyelids are swollen, and tears trickle down the face; the conjunctiva varies in shade from a bright scarlet to a modena red; a mucous discharge flows from the nostrils, and increases in viscosity as the disease advances, often becoming sanguineous in the latter stages: yellowish spots, *mucous vari*, may likewise be seen scattered here and there on the pituitary membrane; the pulse early gives evidence of febrile excitation; at first it is quickened and somewhat increased in force, numbering about 95 beats in a minute; later

on it becomes tremulous and indistinct, even over the region of the heart ; rumination is suspended, and all food refused ; but the patients shew a great disposition to take water, and also to lick earth, which, mingling with the mucus of the nose, assists in clogging up the nasal openings, and renders the respiration more difficult. The alvine evacuations are but little changed in the majority of cases ; in some, however, diarrhoea succeeds to a torpid condition of the bowels, and hastens the fatal termination : the temperature of the body is unequal ; the feet and ears being generally cold, while the skin elsewhere is hot.

These symptoms, more or less modified, are present from the commencement of the eruption, and seldom abate until the papular stage gives place to the vesicular, when the animals usually experience a relief. In all natural cases the constitutional disturbance is great, and makes the probable termination of the attack doubtful, which is also rendered more uncertain when the confluent form of variola prevails ; for the type of the disease, as elsewhere stated, governs, to a considerable extent, the amount of the fatality.

Not only is the prognosis unfavourable in confluent variola, but it is equally so if the fever continues unabated ; which is certain to be associated with an augmentation of the patient's sufferings. The breathing now becomes rapid and painful ; the inspirations frequently, but more often the expirations, are accompanied with a moan ; frothy saliva is discharged from the mouth ; the exhalations are fetid ; the wool separates from the skin on the application of the slightest force ; ulcerations of the conjunctival membrane occasionally result, and sometimes the in-

ternal structures of the eye give evidence of disorganization: the animal shrinks from the touch, the pulse gets more and more indistinct; great prostration of all the vital powers succeeds, and death closes the painful scene. Captain J. Carr thus describes the symptoms when the disease takes on a malignant form: —“ The pulse becomes increasingly rapid, the mouth dry and hot, the breath fetid, and the eyelids, and even head, so much swollen, that the creature can scarcely be recognised. The pustules, being very numerous, become confluent, and form a mass of matter which, especially in warm weather, is apt to assume a putrid character, degenerating into malignant ulcers, by which the poor animal is rendered blind, lame, or loses part of the lips, and is at length carried off by violent diarrhoea \*.”

The pecuniary loss to the agriculturist, arising from the breaking out of the malady among his sheep, is not simply confined to the number of deaths; for even if the animals pass safely through the attack, their weak and emaciated condition renders them of little worth, and the subsequent care and attention which they require for their perfect restoration are considerable, and necessarily attended with great expense. According to Sacco’s statement, “ impregnated ewes are certain to abort their lambs †:” the loss which such a circumstance would cause can scarcely be estimated. We entertain serious apprehensions that Sacco is too correct in this remark; for we have many proofs that sheep, like other domesticated animals—cows in particular—are very liable

\* Sheep-pox, p. 6.

† Trattato di Vaccinazione, p. 150.

- to abort their young when only slight causes interfere with their general health or condition.

In the majority of fatal cases of sheep-pox, death occurs during the first week of the eruption; under ordinary circumstances, however, the chief danger has passed, and the health of the animal begins to improve, when the vessels of the skin have eliminated the variolous poison from the system by the exudations thrown out beneath the cuticle. Most of the continental authorities agree in stating that the constitutional symptoms diminish in severity when the eruption is complete, especially if the disorder assumes the distinct type: they also speak of a recurrence of the fever during the suppurative stage. Sacco affirms "that this period is the *most* dangerous, and that during it the patients abstain altogether from food, and utter tones expressive of great pain; they heave quickly at the flanks—the eyelids and lips are tumefied—a viscid and fetid mucus flows from the nostrils, and an augmented quantity of saliva from the mouth—they never move from the fold—the prostration of their strength is great, and they lie principally on their sides—the tenderness of the body is so extreme, that a simple touch will produce convulsions—the alvine evacuations are copious and offensive—and the deranged condition of the alimentary canal speedily carries them off\*." We can bear testimony to the correctness of these observations, and have in the second chapter recorded the fact, that the pest was most destructive to Mr. Statham's sheep in the first and third stages, *i. e.*, during the periods of papulation and approaching ulceration.

\* *Trattato di Vaccinazione*, p. 150.

It is difficult to speak positively with regard to the number of deaths likely to take place in a flock from the introduction of the natural ovine-pox; for great variations are observed in its malignancy. We fear that in the least destructive instances the mortality cannot be estimated at less than 25 per cent.; while in numberless cases this is more than doubled. It appears by Mr. Fielder's letter, that nearly half of his sheep which were attacked, fell victims; and M. Vitet says that this is a frequent consequence. The deaths in Messrs. Statham's and Weall's flocks may be put respectively at 34 and 38 per cent.; and we are informed that other persons have lost considerably more than this proportion. Mr. Mayer, in an article already quoted, remarks that "it is not unusual for nearly the whole [flock] to be swept away." Sacco makes a similar statement; and Captain Carr observes, that in a malignant outbreak "the certain destruction of the greater part of the flock may be anticipated:" and again, that in a village contiguous to his estate, 'where contagion was allowed to take its course, there was not, to the best of his recollection, a single sheep left alive \*.' To these statements it is unnecessary to add more, as they too plainly shew the devastating effects of the scourge.

In the preceding portion of this treatise, an account is given of the morbid changes which were discovered by an autopsy of three cases; but we shall here insert some further particulars with reference to the lesions that result from the variolous poison being received into the system, as we have latterly had several opportunities of instituting other *post-mortem* exami-

\* Sheep-pox, p. 6-9.

nations. In most instances the mucous membranes, especially of the respiratory system, are the principal parts affected : the serous membranes, however, do not escape ; but, for the sake of perspicuity, we shall describe *seriatim* the lesions of the different organs.

The condition of the common integument will depend altogether on the time that the animal survives. If death takes place in the early stages, papular elevations, a few of them covered with vesicles, are abundantly spread over the surface of the body : in the latter stages, ulcers of various size and depth are met with. The skin also varies in colour, being in some parts of a red, in others of a blueish-black hue, and every where the slightest force will separate the wool from its follicles. The sub-cutaneous areolar tissue is more or less engorged with blood, and purulent formations often exist immediately beneath the confluent papulæ. Infiltration of albuminous serum into the cellular tissue of the face and the extremities is occasionally present. The conjunctiva and transparent cornea in many instances are free from disease, but now and then give signs of approaching ulceration. The pituitary membrane always exhibits an abnormal condition ; but in different animals it presents various degrees of sanguineous congestion, and is frequently so much inflamed that disorganization ensues. In many cases it is studded here and there with *mucous vari* of a light copper colour : these vari, which we have elsewhere called yellowish spots or nodules, are doubtless internal papulæ modified by the structure on which they are developed ; *fig. 1, plate 4*, gives a representation of them. Hurtrel D'Arboval, in his description of the *clavelée*, seems to doubt the existence of papulæ

in the mucous membranes of the *alimentary canal*; but, speaking of the *post-mortem* appearances, he states that the *lining membrane of the trachea* is marbled in spots, *mucose marbrée de taches*, which differ in colour\*: are they analogous to mucous vari? These lesions are not simply confined to the nasal portion of the respiratory system, but extend into the larynx, trachea, and bronchi: *see fig. 2, plate 4.*

Occasionally small ulcers are situated on the epiglottis and other parts of the larynx, and along the course of the mucous membrane; rarely, however, do they extend as far as the bronchi. The smaller bronchial tubes and air-cells of the lungs are mostly filled with dark coloured mucus, and are, in general, less engorged with blood than the other portions of the air-passages. The serous membranes of the thorax are comparatively free from disease: we have seen them, however, very much inflamed; and in one instance the greater part of the surface of both lungs was adherent to the sides of the chest by a thick layer of colourless fibrin: the lobes of these organs were, in like manner, glued together; the outer portion of the pericardium was coated with lymph; the heart was inflamed and partially united to its sac by bands of fibrin; an effusion of serous fluid also existed in the pericardial and thoracic cavities. Such appearances are unfrequent, and in general the lungs are congested, and *liver-coloured spots*, irregular both in size and form, are seen immediately beneath their pleural covering. The digestive system shews fewer traces of morbid action; the buccal membrane and the velum palati are sometimes inflamed, but we have not ob-

\* Art. *Clavelée*, p. 471.

served any lesions on the lining membrane of the oesophagus, rumen, reticulum or omasum ; the villous coat of the abomasum is in some cases infiltrated with blood, and ecchymosed. The cavity of the abdomen occasionally contains an effusion of serum ; the peritoneal tunic is even more rarely inflamed than the other serous membranes, and the intestines are free from disease, except when the patient sinks from diarrhoea, in which case they participate in the general morbid changes, and contain fluid and fetid ingesta. The kidneys are sometimes softened, and now and then similar spots to those seen on the lungs exist beneath their capsules ; for the most marked case of which we are indebted to Mr. Ceely, who kindly forwarded the morbid parts for the inspection of Mr. Marson and ourselves. The bladder and other urinary organs are unaffected. The generative system does not participate in the disease, and, according to the French authorities, when an impregnated ewe is carried off by the malady, the foetus gives no indications of it. The spleen is often enlarged, and the liver soft in structure, sometimes pale, but more frequently of a dark colour ; the condition, however, of this organ in the sheep cannot be said to afford any correct evidence of the existence of small-pox, for it undergoes a variety of structural changes from a multiplicity of causes, some of which are the very reverse of each other. The brain and spinal marrow are affected in some animals, and free from disease in others : simple congestion, either of the meninges, or substance of the encephalon, is the morbid product usually observed.

It is now our intention to describe the general management which should be adopted to mitigate the

severity of the disease, and to stay its destructive consequences. This may be spoken of under two heads, medical and hygienic treatment, of which the latter is, probably, the most important. The first thing which should be done is, to separate the infected from the apparently healthy sheep, and to place the latter at such a distance as to prevent the liability of their being contaminated by subsequent infection. Under no circumstances should this precaution be neglected; for various degrees of susceptibility to receive the poison exist among the animals, and consequently many may thus be saved an attack. These sheep should also be inspected daily, and any of them which shew the slightest symptom of ill health should forthwith be taken away. We cannot give a better proof of the advantage of such a proceeding than by adverting to the outbreak on Mr. Statham's farm, where, notwithstanding that all the sheep lived together for nearly a fortnight after the disease occurred, 43 out of 256 escaped entirely by the rigid adoption of the above method.

We also recommend that the animals which give no evidence of illness, should be supplied with such food as is best calculated to keep the system in health and vigour: the selection of the diet must, however, depend on the season of the year, and on the plan of husbandry which is carried out by the cultivator of the land. If the sheep can be placed on natural or artificial grasses, provided they are not too luxuriant, or growing on a wet or badly drained soil, so much the better; if not, tuberous roots, such as turnips, mangold-wurzel, &c., must be given to them in moderate quantities. They ought also to be allowed, in the latter case, a fair proportion of cut hay of the best quality, with a little corn;

oats are to be preferred, to which should be added a small quantity of salt, to assist the digestive and assimilative functions; or rock-salt may be placed in their troughs. Fresh water should likewise be within their reach.

When the malady continues to shew itself among these isolated sheep, no time is to be lost in administering an aperient to each, which may consist of magn. sulph.  $\frac{3}{2}$ ij to  $\frac{3}{2}$ ijj, p. aloes 3ss, p. rad. zingib. 3ss, aqua tepid.  $\frac{3}{2}$ vijj. Greater attention should be paid to their diet; all debilitating causes removed, and the animals protected from every extreme of atmospheric change, particularly wet and cold. Beyond the exhibition of aperient medicine once or twice, and strict adherence to the rules of management we have suggested, we do not consider that any thing more is needed in the way of prophylactics.

We come now to speak of the treatment that is necessary to assuage the malignancy of the disorder when established. Our efforts must here be directed rather to assist Nature, than actively to interfere with her course; no attempt should, therefore, be made to stop the progress of the affection. Favourable deductions are to be drawn from the regularity with which ovine-pox passes through its several stages, and consequently, if we can prevent it from taking on the irregular or confluent form, much good will be accomplished. Hygienic principles are our chief auxiliaries for this purpose. If the disease occurs during the winter season, the patients must be removed from the fields into sheltered and well-littered yards, and too many of them should not be placed together. It is better to separate them into lots, the respective divisions consisting of

those which are in the same stage of the malady; as thereby a great facility will be given both for administering medicine and attending to their comforts.

Many advantages will likewise arise, even in the summer months, by the sheep being brought as near home as possible, and by placing them in folds in which a temporary shed of hurdles woven with straw is erected, where they may be protected from the rays of the sun or sudden storms. Mangers for the food, and troughs for water, are to be put into these folds, and every arrangement made for attending to the animals with as little inconvenience as possible.

Although a loathing of food is among the earliest symptoms of the affection, yet the appetite of the patients ought to be tempted with all varieties of provender: we would scarcely forbid any thing as the disease advances, for the quantity they take is generally so small that no injury can result from it. At the commencement of their illness, grass, clover, tares, or any green food which has been mown a few hours and partially dried, is to be preferred: this kind of diet tends to promote healthy digestion, to keep the alvine evacuations of a proper consistence, and is not too stimulating to the system. In the place of this, when the season of the year prevents it being obtained, eat turnips or carrots, with good hay; or bran, or linseed cake and hay chaff, may be used; to which should be added a little salt. In the latter stages of the malady, bruised corn, as oats, peas, or beans, must be given, and every expedient of feeding had recourse to which will support the strength of the animals: a varied diet is best calculated for such a purpose, tempting the appetite with tuberous roots al-

ternated with linseed, hay, corn, chaff, &c., and sprinkling the food with salt and water.

When much debility exists, the patients must be drenched with oat or pea-meal gruel twice or thrice a-day, substituting for it now and then half a pint of good ale. Great care is required in administering these beverages, and no unnecessary force should be used. If the animal coughs while taking a draught, the head must be immediately liberated, or suffocation may result : for want of due attention to this simple rule many valuable sheep have been destroyed ; it therefore ought to be well impressed on the mind of the flock-master. A small drenching horn, with an opening at the lesser end, and fitted with a moveable cap at the other, is the most useful instrument for exhibiting fluids to these animals.

Throughout the progress of the malady the patients should be disturbed as little as possible ; both the agriculturist and the veterinary surgeon ought never to lose sight of the fact, that sheep bear up very badly against acute diseases, and that slight causes will greatly tend to aggravate their illness. Besides feeding and nursing the animals in the way recommended, care must be taken to supply them with plenty of water, which should be renewed at least once a-day ; for although much thirst prevails, especially during the papular and vesicular stages of the disorder, the sheep will often refuse to drink in consequence of the mucus which flows from their nostrils being mingled with the water.

When ovine variola assumes even its mildest form, many of the patients will suffer more than others, and to these the chief attention is to be given ; the

worst cases, irrespective of the stage, may therefore be put together if hygienic rules are alone required for their restoration: but this plan is objectionable when medical care is also necessary; as the affection must be treated differently in its several stages, and an inconvenience will result from the patients being mixed.

We shall now describe the other curative measures to which recourse ought to be had, and will first observe, that, whenever the disease shews itself in a flock, the agriculturist will best protect his interests by consulting a veterinary surgeon, to whom must be left the particular treatment required for the several cases. In a work of this kind general rules alone can be given, modifications of which will be necessary in many instances.

The fever of sheep-pox is of a specific nature, and has a great tendency to become typhoid; depletive remedies ought, therefore, to be employed with due circumspection, even in the early stages of the disease. When the bowels are constipated, and the variolous eruption is largely diffused over the skin, an aperient may be administered; but it should be avoided if diarrhoea or much debility exists. We would recommend the following formula:—

B.	Sol. aloes .....	5ij*
	Tr. gent. comp.....	5ss
	Aq. menth. pip.....	5ij
Fiat haustus.		

\* *Solution of Aloes.*

Take of Spiked aloes in small pieces.. 1 part

Distilled water .. .... 7 parts

Proof spirit ..... 1 part

Dissolve the aloes in the water by means of the water-bath, and when removed add the spirit.—*Morton's Manual of Veterinary Pharmacy*, p. 94, ed. 4. London, 1847.

Blood-letting is rarely admissible, only, indeed, when the febrile excitation is very marked : the loss of a few ounces of blood generally produces an irregularity in the action of the heart. If venesection is tried, it should be at the commencement of the disease : the pulse must be carefully watched, and the flow of blood stopped immediately on any diminution taking place in the force of the heart or arteries. The day following the exhibition of the laxative medicine, the patients may be allowed a free use of nitrated water, made by adding potass. nitras  $\frac{3}{ss}$  to every gallon of water which is placed in their troughs, and this may be continued for five or six days, or until a subsidence of the fever takes place. In those cases that do not require aperients, the nitrated water may be allowed from the very commencement. When the symptoms do not yield by the adoption of these means, early recourse should be had to other febrifuges, in conjunction with sedatives, care being taken that they are not pushed too far ; the following compound is available for such a purpose :—

B.	Tr. digitalis . . . . .	mxx
Spt. æther. nitr . . .	$\frac{3}{ss}$	
Liq. ammon. acet. . . .	$\frac{3}{ss}$	

Fiat haustus.

When the acuteness of the attack has passed, and the eruption proceeds regularly through its several stages, few medicaments are needed; but in very many instances increasing debility, accompanied with a loathing of food, follows, and, unless active measures are adopted to counteract these symptoms, exhaustion of the vital powers quickly results. Tonics must now be administered, and of these agents the preparations of iron are

to be preferred. Let the sulphate of iron be substituted for the nitrate of potass in the animals' drink, adding it in sufficient quantities to slightly alter the taste of the water. In addition to this give powdered ginger, gentian, and cinchona, in half-drachm doses, mixed with some good ale. Well nurse the patients, and dose them frequently with gruel, hay-tea, and similar dietetic agents. In extreme cases, diffusible stimulants in conjunction with both vegetable and mineral tonics must be employed. We have used the following mixture with success, adding to it half a pint of ale :—

Ferri sulph. . . . .	9j
Tr. cinchonæ comp.	
Tr. gent. comp. . . . .	ā ā 3j

In this stage of the malady, more particularly if it is confluent, diarrhœa is likely to come on, and, unless arrested, may quickly carry off the patient: too rarely shall we be able to check this morbid action in the alimentary canal; but efforts to do so must be made. Opium is a valuable agent for such a purpose, and may be administered in the following form :—

R. Pulv. opii. . . . .	gr. xv
Pulv. gallæ.	
Pulv. catechu. . . . .	ā ā 3ss
Decoc. sem. lini. . . .	Oss

Fiat haustus.

From these observations it will be evident that some modifications of the general rules here given for the treatment of the disease will be required, which should be left to the judgment of the medical attendant, who will not fail to apply such remedies as are best suited for each particular case. The repetition of the doses,

and the length of time each prescription should be continued, must likewise be regulated by the state and condition of the patient.

All applications to the skin are to be avoided in the early stages of the malady, as they would be productive of harm by checking the progress of the eruption; but when the process of ulceration has commenced, the parts should be daily dressed with a stimulating agent. We can speak practically of the good effects which follow from the use of diluted chloride of zinc to the ulcers of sheep-pox: we prefer it to every thing else which we have tried. Its antiseptic and disinfecting properties render it also a valuable agent in many cases besides those above named. Mr. Morton, writing of the compounds of zinc, remarks, that "the disinfectant fluid of Sir William Burnett is a solution of the chloride of zinc; and, being now easily obtained, this may be made available for veterinary purposes. It is a compound which may be advantageously had recourse to for ill-conditioned wounds, as it corrects foetor, and rouses the parts into healthy action; requiring for this purpose dilution with water, otherwise it acts as an erodent\*."

When describing the symptoms of ovine variola, we alluded to the liability of the nostrils to be obstructed by a viscid mucus adhering to their openings: due attention must be given to this, and its removal effected by frequently sponging the parts with tepid water, and slightly smearing them with the fol-

\* Manual of Veterinary Pharmacy, p. 367, edit. 4.

lowing application, to prevent the mucus from again accumulating :—

B.	Liq. plumbi diacetat.....	5j
	Lactis flor.....	5ij
Fiat mistura.		

As this preparation thickens by keeping, a larger quantity than will be required for two or three days should not be made at a time.

We close this division of our subject by strenuously impressing on the minds of the agriculturists, that all specific nostrums must be avoided, if they are anxious to diminish the losses arising from an outbreak of this direful scourge. The principles which we would lay down for their guidance are, to isolate the infected sheep from the healthy,—to separate the former into small lots,—to protect them from atmospherical changes,—to husband the strength of the patients by good nursing,—to use depletive remedies with the greatest caution, and only in the first stages,—to have early recourse to stimulating and tonic agents,—to guard against the use of local applications except when ulcerous sores exist,—and last, but not least, to call in the services of a properly educated veterinary surgeon, and rely with confidence on his judgment and skill.

## CHAPTER V.

SMALL-POX INOCULATION—ITS INTRODUCTION INTO ENGLAND—INOCULATION OF SHEEP, OR OVINATION—EXPERIMENTS—CONFLUENT SHEEP-POX FOLLOWING OVINATION—PREPARATORY TREATMENT—EXPERIMENT WITH PUNCTURES AND SCRATCHES—LOCAL SYMPTOMS—TIME TO TAKE THE LYMPH—INOCULATED AND ERUPTIVE VESICLES—EXPERIMENTS—PRIMARY LYMPH, AND MEANS TO IMPROVE IT—EXPERIMENT WITH LYMPH OF FOURTH REMOVE—EXPERIMENT OF INOCULATING AND EXPOSING TO CONTAGION SIMULTANEOUSLY—SECONDARY ERUPTIONS—PROTECTION AFFORDED BY OVINATION—SUBSEQUENT TREATMENT—HURTREL D'ARBOVAL'S REMARKS ON GANGRENOUS TUMOURS.

In this section of our Essay we propose to treat of the inoculation of sheep as a means to protect them against future attacks of the small-pox: we shall also describe the phases of the inoculated disease, and record several experiments which were instituted to determine the practicability of having recourse to ovination as a preventive measure.

The great mortality produced by the small-pox of man, early attracted attention; and long prior to surgery being practised as a science, inoculation seems to have been adopted for the purpose of diminishing the fatal effects of the malady. This plan of communi-

cating variola soon extended, and medical practitioners became its advocates ; for experience demonstrated the readiness with which the disease could be transmitted from person to person, its mild character, and the security it afforded to those inoculated. Veterinary surgeons, stimulated by these examples, attempted to propagate the sheep-pox in the same manner, and similar results followed ; as equal immunity was afforded to the animals, and fewer deaths took place than from the natural disease.

Various opinions prevail among medical historians as to the origin of inoculation, which undoubtedly was practised in Asia long before its introduction into Europe. It is supposed by many to have been early known to the Chinese ; and Moore, in his treatise on the subject, states that “ Father D’Entrecolles was of opinion that it was introduced about the sixteenth century ; but other Missionaries assure us that the practice was invented in the tenth ; and there is a tradition that it began as early as the dynasty of Song, which was in the year of Christ 590.

“ These different dates, perhaps, may be accounted for, from the practice having been long kept secret ; and it appears neither to have been very general nor much approved of in China.

“ No account is handed down of the origin of this custom ; but the reverence in which agriculture is held by the Chinese may have suggested the name, and the usual manner of performing the operation. For they took a few dried small-pox crusts, as if they were seeds, and planted them in the nose. A bit of musk was added, in order to correct the virulence of the poison, and perhaps to perfume the crusts ; and the whole was

wrapt in a little cotton, to prevent its dropping out of the nostril\*."

This method of transmitting the small-pox was followed by the Bramins in Hindostan, and also by the Persians, Armenians, and Greeks. We learn likewise from the same authority that "the operation was variously performed, and on different parts of the body, in the several countries where it was introduced; but it always consisted in scratching or puncturing the skin, and inserting into the wound variolous matter. The Circassians, to make sure work, employed three needles tied together, and pricked the body in five different places, inserting matter in them all†."

The introduction of inoculation into England is attributed to Lady Mary Wortley Montague, who, when residing in Turkey in 1717, at the time her husband was ambassador to the Ottoman Court, determined to have her son inoculated, in consequence of ascertaining that the old women were in the habit of inoculating children every autumn, and that the small-pox thus produced was usually mild. The son having passed favourably through the malady, she, on her return to this country in 1722, submitted her daughter to the operation with a similar result. This example was followed by Dr. Keith inoculating his son, and the practice emanating from such a source soon became general. Plumbe states that, "shortly after this, Caroline Princess of Wales, one of whose daughters, the Princess Anne, had been much disfigured, and had nearly lost her life by the small-pox, became anxious

\* History of Small-pox, p. 218, & seq. London, 1815.

† Ibid. p. 224.

to have the rest of her children inoculated, and thus protected against similar misfortune. Further experiments, however, became requisite to give her the necessary degree of confidence; and George the First pardoned six condemned felons in consideration that, for the good of the public, they should submit to be inoculated. The surgeon refused to perform the operation, dreading a failure, and fearing to be stigmatized for doing the work of the executioner!

“ The statement of a physician who had been in Constantinople, conveying the results of his observations, and his opinions on the practice, however, seem to have quieted apprehension so far as to have carried into effect her Royal Highness’s wishes. Five of the felons contracted the disease favourably; the sixth was not affected; and a seventh escaped hanging on the easy terms of having a few small-pox crusts thrust up her nose.

“ It was next tried on eleven children of the parish of St. James, who all did well: and, finally, the Princesses Amelia and Carolina underwent the operation with the like results. As the practice from this time began to spread, however, fatal cases occurred; and instead of inoculation proving to be entirely harmless, it was found that in eight years 845 had been inoculated, and 17 died, making one death in fifty inoculations \*.”

In 1746 the Small-pox Hospital was established for the reception of poor persons suffering from the disease, and for the gratuitous inoculation of children and those individuals who had hitherto escaped it. The extension of the system became, however, a fruitful

\* Plumbe on Vaccination, p. 37 & seq. London, 1832.

means of adding to the mortality ; for it appears, by the statistic records, that the deaths from small-pox, which for ten years, six before and four after the founding of the hospital, had averaged  $72\frac{1}{2}$  in every 1000, rose during the next ten years to 103, and in the next to 111. We have thought that these particulars, although they do not bear immediately on our subject, would be both interesting and instructive, as they plainly indicate the power of inoculation to spread a loathsome and dangerous malady, notwithstanding fewer lives may be directly sacrificed by it than by the natural small-pox.

According to Hurtrel D'Arboval, the inoculation or ovination of sheep was proposed by Chalette in 1762, by Bourgelat in 1765, and by Coste in 1797. The operation is usually performed by surgeons or veterinary surgeons, and occasionally by agriculturists : its general adoption is strenuously recommended by continental authorities, and it appears to be annually had recourse to in many parts of Italy, Prussia, Austria, and France. Captain Carr, in the treatise previously quoted, observes that "an immediate resort to inoculation will not only generally rescue nine-tenths of the still unaffected sheep from all dangerous attacks, but often lighten the disorder to even those individuals of the flock on which symptoms of disease had already manifested themselves." And he further adds, that "about seven years ago I heard of the disease having appeared in this neighbourhood, and resolved at once to try inoculation, of the good effects of which I had both read and heard from credible sources. On close examination of the flock, a few sheep were found to be already infected. These were, however, along with all

the others, lambs included, inoculated in the ear, in conformity with the published recommendation of the Austrian Government in Bohemia; and the result was in the highest degree satisfactory, as we did not lose above one per cent. of sheep, and six per cent. of lambs\*."

Similar statements of the beneficial effects of inoculation, *even when variola has appeared in a flock*, are contained in the writings of the French and Italians. The experiments hitherto carried out in this country are too few either to confirm or negative these remarks, but we cannot withhold our assent from their accuracy. Mr. Mayer objects to inoculation, and says, "I should myself question its policy, as it tends to perpetuate a disease in the country, which by sanitary regulations on the part of the government, and the active co-operation of local authorities and agriculturists, might be arrested in its course, and thus die out †." Abstractedly considered, there is sound reasoning in these observations; but as necessity may compel our flock-masters to take other measures to save their sheep besides those alluded to in this extract, the propriety of inoculating the animals must be investigated on its merits, or capability of effecting the desired object.

We should bear in mind, that, when ovination is adopted as a prophylactic, the danger to the animals themselves depends entirely on the artificial conveyance of the variolous virus into the system, and that the deaths which result therefrom are comparatively few. This circumstance alone would lead us to

\* Sheep-pox, p. 8, & seq.

† Veterinarian, vol. xx, page 630.

speak favourably of the operation, notwithstanding the weighty objections which can be urged against it. The chief of these are, that the inoculated is equally as contagious as the natural ovine-pox, and that therefore the disease will spread unless the greatest care is taken to prevent even indirect contact between the infected and healthy sheep. The confluent type of variola is likewise found to follow ovination, and the serious consequences of this have been frequently alluded to. These are obvious defects in the system; nevertheless it has many warm supporters, from the fact of its being less destructive to life.

Several writers affirm, that, when the natural small-pox is allowed to run its course, the greater portion of the flock will be sacrificed; but if inoculation be had recourse to, it is seldom that more than a *twentieth part* is lost, while it often happens that *the whole* will pass favourably through the disorder. The experiments performed at the Alfort Veterinary School shew that only one death in four hundred cases was caused by ovination. In Hurtrel D'Arboval's treatise on *Clavelée*, it is recorded that 32,317 sheep were inoculated, out of which 32,121 took the disease, and 196 escaped; that of the 32,121 infected animals, 31,851 recovered, and 270 died; being at the rate of three in every 400. The efficacy of the operation was further tested by exposing at different times 7,697 of the inoculated sheep to the influence of contagion, and not one of them suffered therefrom.

Many other particulars of a similar kind might be added, but no better proofs could be afforded of the beneficial effects of ovination. Our experiments are

too limited to suggest correct conclusions ; and they have shewn a result so different, that, were we to found an opinion of the merits of ovination on them alone, it would not be in favour of the practice. The deaths have been at the rate of 20 per cent. ; and even greater losses have attended Mr. Ceely's experiments, as he informs us that 4 sheep died out of 15 which he inoculated\*. Nevertheless, in the event of sheep-pox becoming an established disease in this country, ovination must be adopted as one means to stay its ravages ; and as we shall hereafter shew, vaccination cannot be used in its stead.

If annual inoculation should be rendered necessary, care must be taken not to operate on very young lambs, as the malady proves fatal to them : it would be expedient, therefore, to delay the operation until the animals are three or four months old. The French veterinary pathologist from whose writings we have so frequently

\* Since the above was in type, we have received the following explicit statement from Mr. Ceely :—" The number of sheep which I inoculated was 15 : of these there died 4, of which 2 were lambs, 1 an ill-conditioned Irish sheep, and the remaining 1 evidently had the disease (from previous exposure) in a latent state when operated on. In the *majority* of my inoculations I took no pains to produce mild cases; on the contrary, I wished,

" 1st,—To multiply my observations of the disease with a full eruption.

" 2d,—To furnish pathological specimens.

" 3d,—To prolong my succession of cases with a view to procure virus for human ovination.

" To produce a mild disease—the usual object of inoculation—was quite a secondary consideration with me ; hence in several cases I made from 6 to 20 punctures. In *two cases* (both of which recovered), I inoculated the sheep with virus abstracted from the vesicles of a dead sheep, on the *fourth* and *sixth* day after death."

quoted, inoculated six lambs, two on the second day after their birth, two on the third, and the others on the fourth: five of the number died in the eruptive, and the other in the second stage of the disease. Similar experiments have been repeated by other persons, and always with analogous results. With the exception of very young animals, sheep of any age may be ovinated; but it is necessary to select the lymph from *the mildest cases*, and to choose, if possible, temperate weather for the performance of the operation. In the opinion of Captain Carr, “the most favourable season for *yearly* inoculation is late in the spring, or early in the autumn\*.”

Many other precautions are needed to secure success; but we refrain for the present from entering fully into these particulars, being desirous of first recording some of our early experiments of ovination.

On *October 22*, a healthy sheep, of the Leicester breed, was inoculated; three small punctures were made, one inside each thigh, and the other on the postero-inferior part of the abdomen; points charged with lymph procured the preceding day, were inserted into two of the punctures, and a portion of cuticle, impregnated with the ichor into the third.

*Oct. 25.*—The incision into which the *scab* was placed has taken on the suppurative action: no change is observed in the other inoculated places.

*Oct. 26.*—A small ulcer, surrounded by a slight areola, exists where the cuticle was used. The other incisions are marked by eccentric spots of a deep red colour.

\* Sheep-pox, p. 11.

*Oct. 27.*—The inflamed spots have increased in size, and are painful on pressure.

*Oct. 28.*—The ulcer alluded to on the 26th has assumed a healthy condition. The other incisions are more inflamed, and a red speck or stigma has appeared about an inch from the circumference of one of these places.

*Oct. 29.—Eighth day of inoculation.* The patient's health is affected, the pulse and respiration are hurried, and the appetite is impaired. The inoculated spots and the stigma are altered in colour, being changed from a deep red to a reddish yellow; their centres are also depressed, and they are encircled by an elevated border of lighter colour than the contiguous skin. The surface of the body is hot, and small isolated patches of a pink hue are present on the inner parts of the arms and thighs: this eruption is probably a modified form of roseola variolosa.—*See the figure in plate 5.*

*Oct. 30.*—The constitutional symptoms have undergone but little change. The efflorescence is more diffuse, and papulæ can be felt deeply embedded in the dermis.

*Oct. 31.*—Tenth day. Both the general and local appearances indicate a favourable termination: papulæ are developed, which are *distinct* from each other. A peculiar alteration has taken place on the ovinated places; a number of minute vesicles, arranged in a circular order, exists within the outer ring or elevated border previously described; a representation of this is also given in *plate 5.*

*Nov. 3.*—Thirteenth day. Each inoculated spot is now covered with a large patch of whitened cuticle,

but no fluid can be detected beneath it (*plate 5*). Vesicles are formed on the papulæ, from which we succeeded in charging a few points.

*Nov. 6.*—The patient's health is much improved, but the punctures are beginning to ulcerate.

*Nov. 8.*—Eighteenth day. Dark-coloured scabs adhere to the surface of the ulcers; these are surrounded by purulent formations distending the epidermis, and imparting to it a yellow aspect (*plate 5*).

*Nov. 12.*—The ulcerative process has not penetrated the dermis; the sores look healthy, and require only time to heal them. The animal is convalescent.

On the same day that the subject of the preceding experiment was operated on, we ovinated another sheep, using fresh dried lymph for the purpose, and making the punctures on the *brisket* and abdomen.

*Oct. 25.*—One incision on the abdomen presents an appearance similar to a flea-bite, but with a greater thickening of the integument.

*Oct. 26.*—Two more of the punctures are inflamed.

*Oct. 29.*—The red spots have extended daily up to this time: they now shew an alteration in colour, and a falling-in of the centre. As in the former case, these changes are associated with symptoms of fever, and with a rose-coloured eruption.

*Oct. 31.*—The constitutional symptoms are augmented: the patient is very dispirited, and stands moping about; the visible mucous membranes are injected; the skin is hot, the pulse rapid, and the breathing increased. Papulæ can be detected on those parts of the body that are generally the first affected.

*Nov. 2.*—*Fifth day* of eruption and twelfth of ovina-

tion. A few small vesicles exist, but they are not sufficiently matured to yield any lymph. Mucous vari can be seen on the Schneiderian membrane. The patient has less fever, and the appetite is returning.

Nov. 4.—The *eruptive* vesicles are numerous, and distended with a clear ichor, which enabled Mr. Mar son, and ourselves, to obtain a supply of good lymph. The inoculated vesicles contained scarcely any fluid, although they were of large size. *Some of the papulae are unchanged.*

Nov. 7.—Brown incrustations are formed on several of the *eruptive* vesicles; and the cuticle is falling in branny scales from *the papulae which did not vesicate.* Slight ulceration of the inoculated places has commenced; but the animal's health is much improved.

Nov. 11.—Pustules have succeeded many of the vesicles; others of them are *umbilicated, and have small scabs on their centres;* these are surrounded with a slight areola. The inoculated sores appear to be healing.

As the progress of the case after this time was satisfactory, and as no features shewed themselves of sufficient importance to merit especial notice, we proceed to give the details of another experiment that was carried out simultaneously with the foregoing, in which the phases of the malady and its termination were altogether different.

Oct. 22.—Patient a strong and healthy half-bred Leicester ewe: inoculated with *fluid lymph:* two incisions were made on the side of the brisket, and one on the inner part of each thigh. No indication of success was noticed till the *seventh day*, when one puncture on the brisket shewed a *slight redness.*

*Oct.* 29.—The inflammation surrounding the puncture is increased. The animal was seen by Mr. Marson, who agrees that the appearances are *specific*.

*Nov.* 1.—A rose-coloured efflorescence covers both the hairy and nude parts of the body : it is particularly manifest on the teats and under-surface of the tail. None of the other incisions have taken.

*Nov.* 2.—The rash has extended, and is of a deeper colour. Very little constitutional disturbance is present.

*Nov.* 3.—Less diffused redness exists, but many well-defined stigmata, which are nearly circular in shape, stud the skin of the udder, labia, and anus. Papulæ can be *felt*. The ovinated spot is highly inflamed, but it does not shew any central depression.

*Nov.* 4.—*Fourteenth day* of inoculation. Papulæ are formed. The stigmata are *flat* on the surface, but bounded by elevated margins. The patient has but little fever.

*Nov.* 5.—Some of the stigmata have disappeared. The papulæ are considerably increased in number, but perfectly distinct.

*Nov.* 6.—Both the constitutional and local symptoms are unaltered.

*Nov.* 7.—Considerable fever is present ; more papulæ have shewn themselves ; those first developed are much enlarged. *No stigmata can now be detected.*

*Nov.* 8.—Symptoms aggravated. Papulæ *confluent* on the inferior parts of the abdomen and inside the arms ; *distinct* on other parts.

*Nov.* 9.—Patient very ill : the lips, nostrils, sides of the face, and eyelids are much swollen ; conjunctiva

of a scarlet hue; Schneiderian membrane engorged and studded with vari; breathing painful, pulse increased, great heat of skin, and shrinking from the touch. The eruption more confluent.

*Nov. 10.*—Effusion has taken place into the cellular tissue of the extremities. The poor animal can scarcely be induced to move; the exhalations are fetid, and the wool separates easily from the follicles. The condition of the integument seems unchanged.

*Nov. 11.*—Some mitigation in the severity of the symptoms has taken place; the breathing is not so painful; the swelling of the head is diminished, and the patient shews a disposition for food, and drinks freely.

*Nov. 12.*—Less febrile excitation: *a few of the papulae are vesicated*; a stage of the disease which has been much protracted, this being the eleventh day since roseola was noticed.

*Nov. 13.*—The general and local appearances have undergone very little alteration since yesterday. Some points were charged, but the lymph was *scanty and very impure*; four of them were, however, used immediately for ovinating another sheep, as we were desirous of ascertaining whether such fluid would impart the disease, and, if so, whether a malignant attack would follow.

*Nov. 14.*—More vesicles are formed, but the majority will not yield any fluid. Many papulae still retain their florid red appearance, while others are disappearing.

*Nov. 15.*—We succeeded this morning in obtaining a little lymph of rather better quality, but not such as we would take by choice. In the evening our patient

experienced a sudden relapse; the respiration became much quickened, accompanied with a frequent and painful cough, and other symptoms which indicated the existence of pneumonia.

*Nov. 16.*—It is evident that the poor animal cannot survive long; the vital powers are nearly exhausted. Examination of the skin shews *papnæ unchanged; large eruptive vesicles distended with a thin and limpid fluid; smaller ones containing an opaline ichor; pustules here and there; and in other parts, approaching sphacelus.*

Late in the day death closed the scene. To narrate the *post-mortem* appearances would only be to give a recapitulation of those described in Chapter IV. We may, however, remark, that this is the case alluded to at page 88, in which the serous membranes of the thorax were principally involved.

We abstain from making any comments on these experiments, as we have others to record, and shall therefore continue our account of ovination. The French inoculators do not consider that any preparatory treatment is necessary, beyond due discretion in the selection of the lymph, the avoidance of the operation during all extremes of weather, and delaying it until the animals are from four to six months old. We, however, should hesitate to inoculate a flock without taking every precautionary measure to secure success, and would invariably so attend to the dieting of the animals for several days prior to the operation, as to produce a healthy state of their systemis. If any doubt of this existed, then we would exhibit suitable medicinal agents, and alter the plan of management until

we were satisfied that the sheep were in a condition to warrant their being inoculated.

The places usually selected for the insertion of the ovine virus are the inside of the ears or thighs, the under surface of the tail, the inferior parts of the abdomen, or sides of the sternum. We prefer either the inside of the thigh or the postero-inferior portion of the abdomen, avoiding in the former case the course of the vessels, and in the latter the mammary gland of the female, or the genital organs of the male. Captain Carr, in giving instructions for the performance of the operation, remarks that "the places best suited are the inner side of the flap of the ear, or the under part of the tail, close to the root. The instrument employed is a kind of needle made for the purpose, with a fine, somewhat flattened point, which, having been dipped in the virus, is carefully inserted between the upper and second skin, cautiously avoiding piercing so deeply as to draw blood, which is found to render the success of inoculation less certain. Of course, in the absence of such a needle, a lancet will answer the purpose \*."

The number of punctures ought not to exceed three, which when made on a plane surface, should be about two inches apart, so as to prevent an extension of inflammation from one to the other, as this would be attended with serious inconvenience and unnecessary suffering to the animal. It is better to have one incision on either side of the abdomen, and a third on the inner part of the thigh. The greatest care is required in making the punctures; for if deep, they are certain to be succeeded by ulceration and sloughing of

\* Sheep-pox, p. 11.

the surrounding integument, often to the extent of two or three inches. *They cannot be too superficial.* Indeed, with primary lymph, i. e. lymph procured from the vesicles of a natural case of ovine-pox, we have found that the slightest incision, even if it did not penetrate the dermis, has been followed by an ulcer, varying in size from that of a shilling to a half-crown.

That Mr. Ceely's experience agrees with our own is evident from the subjoined extract from one of his letters :—“ I find superficial *scratches* better than punctures ; and I place the lymph upon them by means of a portion of moist cuticle recently removed from a vesicle, and secure it with a piece of adhesive plaster : *large punctures are sure to be followed by extensive or deep and dangerous sloughing.*” Hurtrel D'Arboval has observed similar consequences, and cautions inoculators against inserting the ovine virus beneath the cutis. Our experiments with scratches have not been equally successful with those performed by Mr. Ceely ; notwithstanding that we have varied the plan of using the lymph. Adopting this gentleman's recommendation, we have fastened portions of the epidermis on the abrasions with adhesive plaster ; at other times we have smeared them over with fresh lymph, while fluid ; and occasionally rubbed in dry lymph, causing it to commingle with the exuded serum. In general, inflammation of an ordinary character has come on, which, as we have elsewhere shewn (pp. 37-8), has been quickly followed by effusion beneath the cuticle, and the expulsion of the virus from the part.

For the sake of comparison between the effects produced by scratching and by puncture, we had recourse to the following experiment :—

Nov. 29.—Three years old sheep; Irish breed; ovinated by scratching the epidermis inside each thigh, and making a slight puncture on the brisket: dry lymph used to the separate places.

Nov. 30.—Swelling is present, associated with diffused redness of the *abraded* integument. No change in the incision.

Dec. 1.—Small pustules are formed on the scratches. The red colour is declining.

Dec. 2.—The pustules have discharged their contents, the swelling has nearly subsided, and the cuticle is desquamating. The *puncture* is marked by the deep red dye of variolous inflammation.

Dec. 4.—The absorbents surrounding the incision are corded; the inflamed spot is larger; but the animal's health is scarcely affected.

Dec. 6.—A few papulae have appeared. These subsequently passed regularly through their several stages, and by the 18th the patient was convalescent.

It will be seen from the cases related in this chapter, that the ovine virus, after being inserted into the system, remains dormant for a few days, and that if the inoculation takes, a *brick-red speck* appears around the incision. This gradually increases until it acquires a size about equal to half-a-crown, when it generally ceases to enlarge, and umbilication of its centre and change in its colour come on: circumstances usually attended with more or less constitutional disturbance. At this period the small-pox may, or may not develope itself in the form of an eruption; this probably depends on the susceptibility of the animal to the poison. For we have many opportunities of observing cases in which only local effects follow ovination, yet equal security

against a subsequent attack is thereby afforded to the animal.

Hurtrel D'Arboval says, that "on the third or fourth day after the operation, sooner or later according to the age and health of the animal and the state of the weather, will the effects of the inoculation become apparent; but if no signs are manifested by the eighth day, it is a proof that the inoculation has failed, and must therefore be repeated\*." We can bear testimony to the correctness of these statements, for, as our experiments will shew, the specific inflammation has appeared sometimes on the third day of ovination, while in one instance it did not come on till the seventh day (see page 110). And we have often been obliged to re-inoculate an animal to secure success, in consequence of its system being insusceptible to the action of the variolous poison when it was previously introduced. The same fact is spoken of by Captain Carr, who uses the following words: "As, however, even with the utmost care, many animals do not take the infection by the first inoculation, it is requisite to examine the whole flock after the lapse of six or seven days from the date of the first operation, and to inoculate a second time wherever the first has proved abortive†."

The period at which lymph can be collected from the *eruptive* vesicles of either the natural or inoculated pox, will necessarily be regulated by the duration of its incubative stage. It is very seldom that the vesicles are sufficiently matured to yield lymph before the

\* Art. *Clavelization*.

† Sheep-pox, p. 12.

twelfth or thirteenth day of ovination; and occasionally we have had to wait even longer than this. One of the most remarkable instances of protracted vesication coming under our immediate notice, is that which we have recorded at page 110 & seq., where we did not succeed in charging points until the twenty-third day; and even then the supply of the fluid was scanty, and its quality very impure. It is, however, to be borne in mind, that an irregularity in the progress of variola is always connected with the confluent variety of the disorder, whether it arises from natural or artificial causes, and that such cases rarely produce a limpid ichor.

The continental authorities assert, that the virus may be obtained from inoculated animals on the eighth or ninth day. But should we be right in the conjecture that these dates have reference to the time at which the inflammation first takes place in the punctures, and not to the period when the operation was performed, then there is only a seeming not a real difference in the statements. Mr. Ceely informs us, that he has seldom been able to obtain lymph before the twelfth day: and in a note received from him when our experiments were being carried out, he gives the following particulars relative to the subject:—“On the fourth day succeeding the inoculation of the animal which yielded the ichor now sent, there were febrile symptoms, and roseola and stigmata near the inoculated parts, which were hard, elevated, and of a brick-red colour. The general and local symptoms increased, and on the sixth and seventh day of inoculation large papulæ appeared, chiefly in the vicinity of the punctures. Subsequently papulæ shewed themselves near the mouth, and eventually the absorbents in the groin, near to the

inoculated places, became indurated. Yet it was not till *the eleventh day of the eruption and sixteenth of the inoculation, that any lymph could be procured from either the eruptive or the inoculated vesicles.*"

It is the opinion of Hurtrel D'Arboval, that the exudations of the inoculated vesicles, although limpid, are not equally efficacious in communicating the disease as those of the eruptive vesicles: extended experience is needed to test the correctness of this declaration, as both Mr. Ceely and ourselves have succeeded in inoculating sheep with the contents of these vesicles, and have not observed the difference spoken of.

The *inoculated vesicles* are in general much larger than those formed on the papulae, and the fluid they contain is less viscid; but if it can be depended on, an advantage will result, for very frequently the others will not yield any lymph, the whole having been imbibed by the cells of the cuticle. Much time and patience are required in procuring a supply of ichor for inoculation, even from fully developed vesicles; and an hour will often be spent in well charging a dozen points. Mr. Ceely in one of his communications says, "I was occupied two hours in charging twelve tubes, and twenty points and lancets: the latter were twice covered. I found that by waiting a few minutes after taking up the fluid from the surface of the vesicles, a further exudation equally limpid took place. I am not disposed from analogy to expect that the later discharge even of an eruptive vesicle, is equal to the earlier. In the vaccine disease only the first exudations are of any value; still I do not think that analogy alone will suffice to determine this point."

As we were desirous of testing the power of the

turbid contents of declining vesicles to communicate the disease, the following experiment was instituted:—

*Nov. 29.*—An Irish sheep was inoculated; small punctures were made on the sides of the sternum and inner part of each thigh, and into these some *milk*y fluid taken from the eruptive vesicles of a sheep that had been ovinated nineteen days before was inserted. The animal which yielded the lymph had experienced a mild attack of the small-pox.

*Dec. 2.*—Three of the incisions give proofs of the existence of the variolous poison.

*Dec. 3.*—Local symptoms increasing.

*Dec. 4.—Sixth day of inoculation.* Papulæ are forming on the breast. Two stigmata are present near to the inoculated places.

*Dec. 6.*—The eruption is very slight. The malady is progressing favourably, and the patient's health is but little disturbed.

*Dec. 8.*—Most of the papulæ are vesicated, others are diminished in size. The punctures are still of a deep red colour, and painful. The stigmata are cup-shaped, and the absorbents corded.

*Dec. 10.*—The contents of the vesicles have an opaline appearance; the stigmata are less visible, but the suppurative action has commenced on the edges of the inflamed spots surrounding the punctures.

*Dec. 12.*—The cuticle is desquamating in brown scabs from the vesicles, and in furfuraceous scales from the papulæ, which did not go on to vesication. The ulcerative process is established in the inoculated parts, associated with greater inflammation of the absorbents.

*Dec. 14.*—Ulceration has extended to the subcutaneous tissue, and large sloughs are being detached.

*Dec.* 16.—The dead portions of the integument are removed, leaving deep chasms to be filled up by granulations.

*Dec.* 20.—The sores are healthy, requiring only time to perfect the healing process.—Two days subsequently a sketch of them was made. *See twenty-fourth day, Plate 5.*

This case differed in no essential particular from others inoculated with limpid fluid; but the local effects were augmented, and the sloughing was more extensive than it generally is; circumstances which might depend on the quality of the matter employed. It is difficult, however, to speak with certainty on this point, as analogous experiments have not invariably terminated in the same manner; and, as the next instance will shew, sloughing equally as great may follow if the lymph is taken from *the early vesicles of confluent variola*. On referring to page 112 it will be seen, that four points imperfectly charged with the lymph of the eruptive vesicles of a sheep affected with the confluent variety of small-pox, were used for ovination. The experiment was performed on November 13, and two days afterwards the specific inflammation of the incisions had commenced.

Seventh day of ovination.—The local symptoms have gradually increased since Nov. 15; and now diffused roseola is present, but the health of the sheep is unaffected.

Eighth day.—A few papulæ can be detected.

Ninth day.—The roseola has declined. Papulæ stationary.

Tenth day.—The inflammation of the punctures still keeps extending: most of the papulæ have disappeared.

Twelfth day.—The cuticle covering the inoculated places has a yellow hue, and looks as if it would desquamate without vesication. All symptoms of the eruption have passed off.

Fourteenth day.—It is evident that sloughing will take place around the incisions.

Sixteenth day.—The vitality of large portions of the dermis has been destroyed, and their separation has commenced.

Twentieth day.—Extensive sloughs have been thrown off; the ulcers however look healthy.

The great liability of the inflammation of the inoculated places to produce ulceration is undoubtedly disadvantageous, and must prove an obstacle to the extension of the ovination. Whether sloughing would follow the use of lymph which had been passed through the systems of a number of healthy sheep in succession, can only be ascertained by diversified and well-arranged experiments. Primary lymph is evidently too virulent; and some plan to mitigate its *local* effects must be devised before inoculation can become general. The statements of the continental writers are contradictory with reference to the change which takes place in the lymph by transmission from sheep to sheep. Some maintain that it destroys its specific properties, so that it no longer induces a disease which will secure the animal against the small-pox; while others contend that, after several transits, a lymph equally as protective, but far less virulent, is produced. Mr. Mayer, in an article chiefly translated from Hurtrel D'Arboval, and to which we have before referred, states, that “after the same matter [lymph] has passed through twelve or fifteen lots of sheep, it loses its efficacy, and requires to be

renewed from sheep having the natural pock\*." Similar assertions occur in the writings of many French veterinary surgeons; but we question their accuracy, and rather give our assent to the observations of Mr. Ceely, who thus expresses himself on the subject:—

" It appears," says he, " by the accounts of French authors, that by transmitting the variolous ichor from sheep to sheep, it undergoes eventual degeneration, and becomes effete; so that a return to the natural disease is necessary. If this be true when great pains are taken to repeat inoculations with lymph in a proper state, viz. clear and limpid, it is a very remarkable and highly interesting fact, and well worthy the attention of the members of the medical and veterinary professions. We know that care and selection in the transmission of the vaccine, are necessary to prevent degeneration, which has often taken place to the injury of patients and the damage of the reputation of the vaccine; but we do not see, when proper care is taken to select good lymph and fitting subjects, that such degeneration ensues, or we should be in a sad state for want of fresh supplies. I should like to be able to ascertain the truth of the statement made by the French inoculators or *clavelizators*, and whether it be a contingent or an unavoidable degeneration. I cannot help suspecting that the difficulty consists in obtaining the virus before it is too late; for there certainly is a difficulty.

" Again, it is said that the virus is not so good from the inoculated as the eruptive vesicles: that is a point of interest. It is very probable that the eruptive vesicles have the lymph less blended with the adventitious purulent products of inflammation excited by the scratch or puncture of inoculation, which will often in man after vaccination spoil one or more vesicles. After all, I cannot but suspect that these difficulties have been overstated, and might be met where large numbers have been *clavelized*. Where one or two only are inoculated, as with the vaccine in man, the supply may be lost, or degeneration ensue."

\* Veterinarian, vol. xx, p. 631.

In a report read before the French Academy of Sciences, by M. Serres, and published in Steinbrenner's *Traité sur la Vaccine*, the following remarks occur:—“ It is well known that agriculturists have recourse to inoculation to stay the progress of the clavelée; and in those districts where sheep are reared, the lambs are yearly inoculated, the virus being selected from an animal which is but slightly affected. If, however, the ichor is transmitted through the systems of several sheep, *we obtain by the tenth remove a fluid which rarely produces a general eruption*, so that the malady induced by inoculation is very mild and unattended with danger\*.”

The declarations of M. Lebel are even more to the purpose. We quote from an article translated from *Le Recueil de Medicine Vétérinaire*, and published in *The Veterinarian*, in which the writer, after giving the details of an unusual fatality arising from inoculation, adds, that

“ There needs no further proof of the contagious property of matter of sheep-pox, be it the product of malignant or benign pox; but it becomes a question, whether or not this property, especially in the latter, does not become weakened under successive inoculations. Hurtrel d'Arboval is of opinion that it becomes so after the fifth time of inoculation. ‘ For my own part, however,’ says M. Lebel, ‘ I would say rather the fifteenth time.’ ”

“ In May 1846, M. Lebel inoculated fifty lambs, the produce of the year. The beginning of June—every thing having proceeded favourably up to that time—sixty-eight newly-purchased sheep, of ages from one to three years, were turned to run with the flock that the fifty lambs had rejoined. From twenty to twenty-five days afterwards—from thirty-six to forty days since the inoculation of the lambs

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\* Page 529.

—some of the new-comers exhibited proofs of infection: twenty of them had got the pox, some confluent, some benignant. Those of the sixty-eight who had not caught the disease Lebel inoculated from the others.

“ This fact establishes the conservative as well as the infective properties of the virus. And, further, the matter Lebel used on the occasion is the same as has served him *for upwards of ten years*. Nor has he, since November 1840, had any natural pox virus: and such is the difficulty, not to say impossibility, to collect matter from natural pustules [?] that Lebel has not troubled himself about it, but has contented himself with what he had in possession.

“ M. Lebel does not, however, deny that the disease, through so many transmissions, undergoes some mitigation, seeing that lambs which he is inoculating year by year with virus which he has by him, experience hardly any derangement of health while the disease is on them, and that it is rare for him to lose more than one in a hundred \*.”

These observations appear to us conclusive, and to fully prove that not only is a purer lymph obtained by the primitive virus being passed through the systems of a number of healthy sheep, but that no loss of its specific properties thereby results.

Its purification by ovinating other animals, as the ox tribe, and then bringing it back to the sheep, has also been attempted, but whether successfully or not, is doubtful, for the statements essentially differ. We do not intend in this place to discuss the question, for in a subsequent chapter we shall give the particulars of some experiments which were undertaken to ascertain whether ovine-pox could be conveyed by inoculation to other animals.

Various expedients have been adopted to preserve the lymph so that it might be depended on for future

\* Veterinarian, vol. xxi, p. 35.

ovinations; all these, however, have failed more or less. The method of collecting it in capillary tubes, and afterwards hermetically sealing them at the end, is probably the best. Mr. Ceely has long been accustomed to preserve the vaccine lymph in this manner, and speaks highly of it. Next to this plan, that of charging ivory points, and allowing it to dry, is to be recommended. How long the lymph will retain its specific properties cannot be determined with accuracy: probably it will be useless after being kept a few months. Captain Carr speaks as if no difficulty existed in preserving it; but he does not say how this is to be done. These are his words:—"where yearly inoculation is practised, it is customary to reserve a stock of inoculating materials from one year to another\*." On the contrary, Mr. Youatt remarks, that "there is one disadvantage attending the use of the *claveau* [lymph], that it retains its power not more than a few days, whatever care be taken of it†." These observations by Mr. Youatt would lead to the inference, that the virus becomes totally inert in a very short time, which however is not the case.

The fresher the lymph, the more it is to be depended on for ovination, as undoubtedly it is deteriorated by age, and ultimately does become inert. Many of its properties, however, depend on its original purity, and great care is therefore necessary in the choice of vesicles from which to take it. Very large vesicles should not be selected, as these in general are filled with little more than ordinary serous exudations; small ones, especially

\* Carr on Sheep-pox, p. 10.

† Youatt on Sheep, p. 544.

when distinct, are therefore to be preferred. It has elsewhere been stated, that the early-formed ichor is the most pure, being limpid, transparent, and viscid.

Having spoken in a former part of this treatise, of the liability of primary lymph to cause sloughing in the ovinated places, we will here insert an experiment with some *lymph of the fourth remove*, which was attended with only slight ulceration.

*Nov. 29.* — Patient a two-years-old Dorset sheep, ovinated inside each thigh with lymph forwarded by Mr. Ceely, who in his communication says, “ Yesterday I had an opportunity of charging some tubes and points from a sheep inoculated from the lamb you saw when here; I have therefore sent you some ichor: *it is the fourth remove.* I charged the points twice from a vesicle the size of a fourpenny piece, adjoining, nay in fact continuous with, the inoculated vesicle. The fluid was as limpid as any I have ever been able to obtain, and I might have charged many more points and tubes than I did.”

*Dec. 1.* — Third day of ovination. A small spot of variolous inflammation has appeared on the site of each incision.

*Dec. 3.* — The inflammation has gradually spread since the 1st. (*See third, fourth and fifth days of inoculation, Plate 5.*)

*Dec. 4.* — Roseola and scattered stigmata are to be seen on the insides of the arms and thighs. The animal has slight fever, and loathes its food.

*Dec. 5.* — The condition of the integument is about the same. The ovinated places are umbilicated, and their redness is diminished.

*Dec. 6.*—The roseola has disappeared; a few stigmata remain, but no papulæ can be detected.

*Dec. 8.*—The constitutional disturbance has passed off; *vesicles are forming on the inoculated places:* with this exception, the skin has regained its normal condition.

*Dec. 14.*—The suppurative action has commenced, and pus is mingled with the contents of the vesicles, virtually changing them into pustules.

*Dec. 18.*—The pustules are drying up; superficial ulceration exists, but it has no tendency to spread.—During the succeeding week the scabs were thrown off, and the sores had nearly healed.

This case is satisfactory, and clearly indicates that the lymph was rendered less virulent by the removes to which it had been subjected. Nevertheless, many similar experiments must be instituted, before positive assertions can be made on so important a subject. We do not hesitate, however, to express our belief, that the most likely way to make the lymph milder, and better suited for ovination, is, to pass it through the systems of several healthy sheep. Ten removes are probably required for this purpose.

As inoculation is frequently adopted to limit the ravages of the small-pox, *when the natural disease has shewn itself in a flock,* (the unaffected animals being subjected to the operation, and allowed to remain with the others,) we determined on exposing an animal to the contagion, and ovinating it during the time. The experiment was unattended with any aggravation or irregularity of either the local or general symptoms, as the following details will shew.

A sheep having been placed in a shed for five days with another labouring under variola, was inoculated with lymph of the first remove, and still kept with the diseased animal. On the fourth day the punctures had taken; on the seventh a rose-coloured efflorescence came out, principally on the hairy parts of the integument, and subsided on the ninth day. *This eruption was unaccompanied with any constitutional disturbance, and was not succeeded by papulae.* Vesicles formed on the places of inoculation on the twelfth day, and underwent the usual changes. Slight ulceration followed; but by the twenty-sixth day the sores were nearly healed.

We subjoin an account which is quoted by M. Vitet from the report of an agricultural committee; it shews that similar experiments have been equally successful. "We," say the committee, "have seen forty-five sheep inoculated with the sheep-pox indiscriminately, mixed with others infected with the contagion, without the effects of the *clavelization* appearing to be greater or more malignant upon them than upon others which were kept apart after the operation\*." Although it does not appear that a separation of the flock into two portions is made, when the natural disease breaks out and inoculation of the unaffected animals is had recourse to, still we should prefer such a plan to that of allowing the sheep to herd together during the time.

Hurtrel D'Arboval speaks of secondary eruptions. We have not as yet seen a well-marked case of this description, and therefore we prefer the insertion of

\* Hogg's Shepherd's Guide, p. 249 & seq. Edinburgh, 1807.

his account, which is as follows:—" As in the natural small-pox, so in the inoculated variety, we sometimes observe an eruption of secondary papulae; but they rarely go on to suppuration, and generally disappear after a short time. Some of these secondary papulae occasionally form pustules, and the fluid which distends them may contain a little small-pox virus; but I do not think that it would be safe to employ this product for ovination. In general, if the variolous inflammation comes on in the punctures by the second or fourth day, then these eruptions do not break out; the contrary, however, is the case when the virus remains dormant for a longer time\*."

We have before alluded to the protection which the inoculated disease gives to the animals, and have also explained that equal security against second attacks is afforded by it, as by the natural ovine-pox. We make mention of this again, for the purpose of adding, *that in every instance after the restoration of the patients, we have subjected them to re-inoculation, and have often re-exposed them to the contagion, but no ill effects have arisen from either of these causes.* By reference to page 105 it will likewise be seen, that 7697 inoculated sheep were afterwards allowed to commingle with diseased animals, and that every one of the former escaped the small-pox. Other cases might be introduced, but it appears unnecessary to do this to establish the protective influence of ovination.

It has been said that if impregnated ewes are inoculated, security is thereby afforded to their offspring. Hurtrel D'Arboval maintains, that, " this opinion is

\* Article *Clavelization.*

erroneous, and that experience proves that the lambs born of sheep which had been affected with the natural *clavelée*, or of those which were inoculated during pregnancy, do not acquire an immunity thereby from the malady\*."

The directions which have been given in our fourth chapter for the management and treatment of sheep infected with the natural disease, are equally applicable to those which have been ovinated, should the symptoms assume an aggravated form. Under ordinary circumstances, however, attention to the feeding and guarding of the patients against the vicissitudes of weather are alone required to secure a successful result. Captain Carr says that

" 1st. Care must be taken to provide them [the sheep] with airy and roomy stabling, so as to prevent them as much as possible from crowding together, which is very apt to induce a malignant state of the disease, even when at first disposed to assume a mild form.

" 2d. It is absolutely necessary to keep them carefully guarded against cold, and especially against thorough draughts.

" 3d. Although, during warm and *dry* weather, both of the above-mentioned evils are avoidable, by placing the sheep during the day-time in a dry, sheltered, and not too distant paddock; still it must be remembered, that exposure to rain, dew, or fog, would prove highly dangerous to them. They must, therefore, be housed at night, and when housed, fed (in addition to good hay) with coarse meal, some of which ought also to be mixed with the water they get to drink†."

To these instructions we will append those given for the management of the animals by Hurtrel D'Arboval, who likewise describes the ill consequences that occasionally arise from neglect. We prefer these quotations

\* Article *Clavelization*.

† Sheep-pox, p. 12, 13

to any statements of our own, for this author has also entered at length into the origin of phlegmonous tumours and ulcers, which are said to follow ovination if due precautionary measures are not adopted; a subject on which we lack experience. D'Arboval observes, that "the inoculated animals ought to be kept quiet, and that all causes which are likely to either increase or retard the effects of the operation should be avoided. If the weather is mild and fine, they may be turned into the pastures to graze, and even allowed to remain out during the night; but on the contrary, in cold and damp weather, they must be sheltered, more particularly at night, and be supplied with nourishing diet. The greatest attention should be given to those sheep which suffer the most. If they are exposed to rain, snow, or severe cold, or even to great heat, or sudden storms, the progress of the eruption will be arrested. The *boutons* (papulæ) lose their prominent form, and become flatter; the skin surrounding them acquires a livid or marbled appearance, which is succeeded by sloughs and gangrenous tumours. Secondary fever sets in, accompanied with a loathing of food, and with rapid exhaustion, ending in death.

"When inoculation has been carried out on a large scale, tumours are often developed upon or close to the punctures; these enlargements are centered in the subcutaneous tissue, and more generally follow deep incisions. The inflammation producing them quickly results in gangrene, and the patient is almost certain to be lost, unless active remedial means are adopted. Occasionally, however, abscesses of various sizes arise from the phlegmonous inflammation. The tumour generally appears between the tenth and twenty-

tieth days of ovination; and when it tends to sphacelus, we find that at the commencement it is hard, and surrounded by an areola, and by œdematosus swelling. It is at first red and very painful, but soon becomes of a bluish colour. Fresh parts are quickly involved in the morbid action, and ultimately sloughing takes place. When the tumour has less tendency to end in gangrene, the swelling and hardness are not so marked, and the skin has a yellowish hue\*." These local effects are invariably accompanied with great febrile excitation, and most of the symptoms of which we have previously made mention are ushered in with rapidity; diarrhoea generally being the immediate cause of death. D'Arboval however adds, that "he has not once noticed the formation of these gangrenous tumours in nearly twelve hundred inoculations of sheep, a thousand of which were operated on by superficial punctures made on the postero-inferior part of the abdomen; and that in order to become acquainted with their history, he has perused the writings of Calignon, La Peyrouse, Vignerie, Voisin, Dupuy, and Girard, from the two latter of which he has derived the most information†."

\* Article *Clavelization*.

† *Ibid.*

## CHAPTER VI.

**O**RIGIN OF VACCINATION—ADVANTAGES OF THE SYSTEM  
—OPINIONS OF CONTINENTAL AUTHORS ON THE VACCINATION OF SHEEP—EXPERIMENTS OF OVINATING SHEEP AFTER VACCINATION—ANALOGY BETWEEN VARIOLA AND SHEEP-POX—VARIOLATION AND SUBSEQUENT OVINATION—SUBSTITUTION OF OVINE FOR VACCINE LYMPH—MESSRS. CEELY'S AND MARSON'S EXPERIMENTS—INOCULATION OF OXEN WITH ICHEOR OF SHEEP-POX—EXPERIMENTS—CONCLUSION.

THE benefits accruing to society from the discovery of vaccination are at the present day so generally admitted, that they require from us no argument either to support or defend them. As Englishmen, we can boast that our country gave birth to that philanthropist, who, by his perseverance, talent, and untiring zeal has thus been the means of saving the lives of thousands. The details that are given in the preceding chapter too painfully prove the great sacrifice of human life which had hitherto been caused by small-pox, and that inoculation, instead of diminishing, was found to rapidly increase the number of its victims. Some power, therefore, to stay the torrent of destruction was needed; when Jenner stood forth, and unaided and alone, nay, discouraged and contemned, raised a barrier which diverted the force of the pestilence. The scourge by him

was stripped of its malignancy, and Death was made to halt in the midst of his revellings.

We read that “ in June 1798, being satisfied with the result of his experiments, he resolved to lay them before the public. He transmitted his manuscript to a correspondent who was in the confidence of Sir Joseph Banks, and requested that it should be laid before him, not doubting that it would soon be printed in the Philosophical Transactions. Jenner had already contributed several articles to that celebrated collection ; and as none of his former papers on subjects of mere philosophical curiosity had been rejected, he naturally expected that an essay promulgating a discovery of vast utility would be favourably received. But the perusal of his experiments produced no conviction ; and he received in reply a friendly admonition that, as he had gained some reputation by his former papers to the Royal Society, it was advisable not to present this, lest it should injure his established credit ! This advice, though given with the best design, was neglected with the happiest consequences ; for although disappointed in his favourite mode of ushering his discovery into the world, he was confident that his work required no patronage ; and, therefore, after the addition of a few experiments made in this interval, he sent to the press his *Inquiry into the Causes and Effects of the Variolæ Vaccinæ, a Disease discovered in some of the western Counties of England, particularly Gloucestershire, and known by the Name of the Cow-Pox.*

“ The title was unattractive, and the style unadorned ; yet this short treatise, from a provincial physician, quickly excited general attention : for Jenner’s name

was already familiar to those most learned in medicine and natural history ; and no man of science could deny the correctness of his experiments, or the justness of his conclusions. A great fermentation instantly arose ; and the subject was hotly discussed, both in professional circles and in general society. Many of the sanguine, and a few of the profound, were at once convinced of the truth of Jenner's opinions : but the cautious suspended their judgment, while the superficial and self-sufficient pronounced at once that the whole was an absurdity.

" The faithfulness of Jenner's statements could only be ascertained by further experiments, and the honour of commencing them is due to Mr. Cline\*." This surgeon having at that time under his care, at St. Thomas's Hospital, a child affected with a disease of the hip joint, which he feared would be aggravated by an attack of small-pox, resolved to try vaccination. " He made a slight scratch on the skin of the hip with the point of a lancet, and held for a minute in the wound a quill charged with vaccine lymph, which he had received from Dr. Jenner. A vesicle in all points similar to his description arose ; the child sickened on the seventh day, and the febrile affection subsided on the eleventh.

" Mr. Cline next inoculated the child with small-pox matter in three places. These punctures inflamed slightly on the third day, and then healed ; and the child resisted completely the variolous contagion†."

We cannot better shew the great capability of the vaccine disease to check the spread of small-pox,

\* Plumbe on Vaccination, p. 27 & seq.

† Ibid., p. 29 & seq.

than by quoting again from Plumbe, who states that “up to 1812, when vaccination had been ten years fully employed, and inoculation at the same time not materially controlled, the average deaths from small-pox were 64 out of every 1000. From 1812 to 1821 inclusive,  $40\frac{1}{2}$ ; and for the eight years ending with 1829,  $34\frac{1}{6}$ \*.”

And again, when discussing the question of small-pox succeeding the vaccine disease, he avers, that “the practice of vaccination has been brought in a very few years to such a degree of perfection, that in competent hands the failures are extremely rare. In the year 1813, a report was published by the Imperial Institution of France, stating that 2,671,662 subjects had been properly vaccinated in France, of whom only seven cases had afterwards taken the small-pox.

“In England no registers have been kept of so vast a number; but the success of some charitable institutions proves, that, when vaccination is properly conducted, there will be very few failures. In the Foundling Hospital of London this practice was introduced in the year 1801; and though the children are sometimes intentionally exposed to the infection of small-pox, yet in sixteen years only one slight case has occurred in which a variolous eruption was suspected. In the York Military Asylum there has been the same success. The National Vaccine Establishment was founded by Government in the year 1809; and in eight years, to January 1817, there had been vaccinated by the surgeons of that institution in London and its vicinity 34,369 persons. And although the small-pox

\* Plumbe on Vaccination, p. 45.

has been constantly prevalent, yet at that period only four of the above number were known to have contracted the small-pox, which is about 1 in 8592 cases ; and in those four the disease appeared in a mitigated form, without danger\*.”

Strange as it may appear, it is nevertheless an admitted fact, that vaccination has received less encouragement from the legislature of England than from most of the governments of Europe. And here, where the operation ought to be best performed, and consequently be attended with the most beneficial effects, the contrary is the case. Plumbe remarks that “ this is strikingly exemplified in the present state of vaccination in Great Britain, compared with its state in other countries in Europe. In the latter, general vaccination was ordered by government : no one who had neither vaccine nor small-pox could be confirmed, put to school, apprenticed, or married. Small-pox inoculation was prohibited : if it appeared in any house, that house was put under quarantine ; and in one territory, no person with small-pox was allowed to enter it. By such means the mortality from this disease, in 1818, had been prodigiously lessened. In Copenhagen it had been reduced from 5500 *during twelve years*, to 158 *during sixteen years*. In Prussia it had been reduced from 40,000 *annually to 3000* ; and in Berlin, in 1819, *only twenty-five persons died of this disease*. In Bavaria, *only five persons died of small-pox in eleven years* ; and in the principality of Anspach it was completely exterminated†.”

\* Plumbe on Vaccination, p. 55 & seq.

† Ibid., p. 47.

These particulars indirectly bear on the subject of this treatise, as by a knowledge of such facts veterinary surgeons were induced to test the power of vaccination to prevent the ovine-pox. The accounts which are recorded by the continental writers of the success of the operation vary so much, that we shall give somewhat at length the statements of those who have investigated the matter. It appears from Captain Carr's remarks, that in the part of Germany where he resides, the vaccination of sheep is not practised. He thus writes:—"I would also venture to suggest that it might be worth while to make experiments with the cow-pox on sheep, since it may possibly produce an amelioration of their disease, similar to that which the human race has derived from the introduction of vaccination\*."

Mr. Mayer, who has been at the trouble to collate from the French, observes, that they "have made varied and numerous experiments to ascertain whether, by vaccinating sheep with the matter of cow-pox, it would not protect them from the small-pox; it however failed in doing so: the fever never developed itself properly in them, and the pock was very imperfectly formed; but when inoculated afterwards with the matter of small-pox, they immediately took the disease, and also caught it equally by infection. When the animal was inoculated with the small-pox matter first, and after its recovery vaccinated, it was no longer susceptible of the action of the vaccine matter even locally†."

\* Sheep-pox, p. 14.

† Veterinarian, vol. xx, page 629.

M. Vitet states, that "in the 25th volume of the *Journal Générale de Médecine*, conducted by M. Sedillot, there is an analysis of a report published upon the vaccination of sheep, and the sheep-pox, by a committee of the Agricultural Society of the Department of the Seine and Oise. From their experiments on vaccination, *clavelization*, and counter-proofs of all kinds, it appears that vaccination has, in general, produced upon sheep only a local, feeble action, very much inferior to that on the human body. It does not appear ever to have affected the general system of the sheep; nor to have excited the slightest swelling in the vessels or glands in the neighbourhood of the part inoculated. But it was found impossible to communicate the vaccine disease to sheep which had had the sheep-pox either recently, or at a distant period; while those which never had had the sheep-pox were very easily affected.

" *Clavelization* produces upon sheep an action creating tumours and pustules, rapid in its progress, though characteristical, and accompanied with symptoms of general affection: the effects of the sheep-pox virus are more disorganizing, and present a more malignant character, than those of the cow-pox virus. On sheep the vaccine disease seems entirely to lose the energy which it exerts on the human system; therefore," say the Committee, "we need not wonder at the little advantage we have obtained from endeavouring to resist the sheep-pox by vaccination: but although our attempt has not succeeded in that respect, our attention and experiments have not been unproductive of advantage, since they have led us to positive results, which were the principal objects of our researches,

and which are always far better than uncertain conjecture\*."

Hurtrel D'Arboval gives the following details, which shew that on an extended scale vaccination has failed : "1523 sheep were subjected to the operation, of which 1341 contracted the vaccine disease, and 182 were not affected. Out of the 1341 sheep, 429 were subsequently exposed to the small-pox, either by direct inoculation, or by being placed among infected animals, and 308 of them were attacked with the malady. He infers, that the escape of the remaining 121 sheep was probably to be attributed to either their non-susceptibility, or to some defects in conducting the experiment; and he concludes that vaccination cannot be substituted for ovination†."

The principal advocate, we believe, for the vaccination of sheep, is Sacco, who states "that in consequence of variola ovina prevailing to a great extent among the sheep in the Apennine Alps in 1806, he determined to vaccinate several of the animals, and to test the prophylactic power of the disease thus induced by subsequent inoculation with the ovine virus. The operation perfectly succeeded, and the sheep resisted the small-pox, although they were mingled with an infected flock." The same author likewise declares, that "he has fully satisfied himself by repeated experiments of the *power of vaccination to destroy the susceptibility of sheep to contract variola*; and that it has been found equally protective by Hussan, Ganneron, Buniva, and others." Speaking of the mild nature of the *ino-*

\* Hogg's Shepherd's Guide. Edinburgh, 1807, p. 246 & seq.

† Article *Vaccination*.

*culated* disease, he maintains “that one preventive is as beneficial as the other, and that every person must admit the great superiority of vaccination, as it does not produce a contagious malady.” He also says that, “at the time he was requested by the Sovereign of Lucca to carry out vaccination in her states, he, assisted by Joubert, surgeon to the royal household, vaccinated her Majesty’s Merino sheep with the most satisfactory result. And that M. Spada, of Macerata, who keeps a considerable number of Merino sheep, having learnt how to perform the operation, continued the practice on his estates, and likewise extended it to the children of his tenants; so that the small-pox, of late years, has not even been heard of either among men or sheep in that district.” And again, that “M. Dandolo, purveyor general of Dalmatia, has his sheep vaccinated in Varese, a province in Lombardy, as a precautionary measure, for as yet variola ovina is unknown there: the operation is usually performed by his brother-in-law, Dr. Grossi, who has employed the *vaccine lymph regenerated* in the sheep with perfect success for vaccinating children.”

When describing the cow-pox as developed in the sheep, Sacco thus writes:—“the phenomenon which accompanies the inoculation of sheep with vaccine lymph is deserving of particular notice; the *eruption of the pustules* [?] takes place regularly, but they are mostly resolved before coming to maturity; the cutis detaching itself in small scales from their surfaces as from the pustules [?] of ovine variola. It is very seldom that true vesicles are produced which are succeeded by the formation of scabs.” The same thing he has observed in the pig; and he asks “whether the pecu-

liarity may not be referrible to the special arrangement of the organism of the integument : the constancy of it," he says, " justifies this conjecture\*." The meaning which we would attach to the expression, " eruption of the pustules," is not that vaccination of sheep is attended with a general eruption, but that the local effects of the vaccine are similar to those which are caused by the ovine lymph. And we come to this conclusion from the circumstance, that the same terms are employed by the French in their descriptions of the ovinated places ; and because the ichor of cow-pox very seldom produces any inflammatory action except on the site of the punctures.

" *Variola vaccinia*," Mr. Ceely observes, " is much modified in the sheep; it quickly passes through the several stages: lymph forms by the fifth or sixth day, and on the eighth the affection terminates. It differs altogether from the vaccine of man, or the cow." The peculiarities here mentioned we have witnessed in every case of vaccination when satisfactorily performed ; in illustration of which we insert two experiments of the kind, which will likewise shew that the vaccine disease did not render the sheep insusceptible to the action of the ovine virus.

*Jan. 20, 1848.*—Two sheep were vaccinated with fresh fluid lymph, furnished by Mr. Marson : six punctures were made in one animal, two on the inside of each thigh, and one on either side of the sternum. In the other, four incisions only were used for the insertion of the lymph.

*Fifth day of vaccination:* In the last named sheep, the disease has taken in all the punctures, but only in

\* *Trattato di Vaccinazione*, p. 146 & seq.

two of them in the other case. *Small vesicles* are developed; these are filled with a transparent fluid, and surrounded by a slight areola. The animals are in good health, the effects being but local.

Sixth day:—The vesicles are larger, and the areola is rather deeper in colour.

Seventh day:—The vesicles are beginning to decline; the areola is less visible.

Eighth day:—Crusts exist on some of the places of vaccination; they have, however, fallen from most of them, leaving a slight blush of redness on the spots.

*Feb. 1.*—These sheep were *inoculated with some ovine lymph* which was taken on Nov. 15, 1847, and was consequently about ten weeks old. They both contracted variola; and although the progress of the disorder differed but little in either animal, we purpose to give the details in full, and shall name one sheep C, the other D.

### *Sheep C.*

Fifth day of *ovination*.—Two of the punctures are inflamed, and on the inner side of one thigh a stigma is present near to the place of inoculation.

Sixth day.—The inflammation surrounding the punctures is increasing.

Seventh day.—The effects are as yet local. The health of the animal is undisturbed.

Eighth day.—The deep red dye of variolous inflammation is passing away; the surface of the ovinated places is depressed; and a rose-coloured efflorescence has shewn itself on various parts of the body.

Tenth day.—The efflorescence has disappeared, and here and there papulae can be felt.

Twelfth day.—Vesicles are forming on the inflamed incisions. The papulae are stationary, from which we infer that they will be removed without passing through their several stages.

Fourteenth day.—The inoculated vesicles are well developed, and we are able to charge several points; the fluid is limpid, but not very viscid. Branny scales are falling from the surfaces of the imperfectly matured papulae.

Sixteenth day.—Patches of whitened cuticle partially adhere to the sites of the inoculation; a small quantity of purulent matter encircles them; and the cutis is beginning to ulcerate.

Twentieth day.—The ulcers are superficial, and have a healthy appearance.

#### *Sheep D.*

Fourth day of *ovination*.—One incision on the side of the sternum and another on the postero-inferior part of the abdomen have taken.

Sixth day.—The inflammation excited by the virus has spread around each incision, and attained the size of half-a-crown.

Seventh day.—No further increase of the inflammation has taken place, but an eruption has broken out, being chiefly confined to the upper and inner part of the limbs. A febrile state of the system also exists, and the animal refuses food.

Eighth day.—With the exception of the ovinated places being umbilicated, there is very little change in either the local or constitutional symptoms.

Tenth day.—The patient's health is improved, the

diffused red-coloured eruption continues, but no papulae can be detected.

Thirteenth day.—The skin has regained its normal condition, with the exception of the places of inoculation, which are covered by blanched epidermis, but no lymph can be collected from beneath it.

Twenty-second day.—Since the last report the cuticle has been desquamated in scabs of a dark brown colour: the exposed sores are fast healing.

These experiments, to a certain extent, confirm the statement of D'Arboval, that the vaccination of sheep cannot be depended on as a prophylactic; and they invalidate Sacco's opinion, that "vaccination is equally as beneficial as ovination." We agree with the first named author; for in no instance in our experience has any variolous inflammation been produced by a re-inoculation, although this has been frequently repeated. It is also worthy of observation, that the lymph which was used in the above cases did not appear to be deteriorated by keeping, a circumstance which clearly shews that the experiment recorded at page 37-8 did not fail from such a cause, but probably from the insusceptibility of the animal to its action.

The near approximation in the nature of varioloid diseases, and the fact that they sometimes can be conveyed from man to the lower animals, and *vice versa*, determined us to inoculate several sheep with *the virus of human small-pox*, that we might investigate the points of resemblance, or any differences in the development or progress of the malady. Our thanks are due to Mr. Marson for supplying the virus and assisting in the experiments; notwithstanding we have hitherto

failed to communicate this disease to sheep. The incisions into which the fluid was inserted put on an ordinary appearance, and gave no indications of that specific inflammation which marks a successful inoculation. Whether the virus would prove uniformly inert in an extensive series of inoculations, we are not prepared to say ; probably it would not ; for we have no reason to believe that the sheep is less susceptible of its action than the cow. There is, however, always a difficulty in transmitting an exanthematous affection, apparently of the like kind, from an animal to another of a different species, although it can be propagated readily enough among animals of the same class ; while from the numerous failures which occur, we might now and then be justified in concluding that some creatures are entirely insusceptible to a virus which easily acts on others. Modifications of the malady are, however, more generally obtained, these being chiefly referrible to the peculiarity of organism.

The small-pox of the human subject, and the cow-pox of the ox tribe, are believed by many eminent pathologists to be so closely allied, that a conveyance of the affection from the former to the latter is said to engender the true vaccine. Mr. Erasmus Wilson remarks, that “ the transmission of small-pox to cattle by means of inoculation, and the consequent development of cow-pox in those animals, is established on abundant evidence, for the chief of which we are indebted to the zealous perseverance of Mr. Ceely, of Aylesbury. It is stated by Dr. MacMichael, in an essay read before the College of Physicians, in 1828, that ‘ vaccine matter having failed in Egypt, medical gentlemen were led to institute certain experiments, by which it has been dis-

covered that, by inoculating the cow with small-pox from the human body, fine active vaccine virus is produced.' M. Viborg, of Berlin, is reported to have inoculated cattle, and several other classes of domestic animals, with success.

"Mr. Ceely instituted a series of experiments on the inoculation of the cow with variolous lymph in the month of February, 1839. In his first subject no effect was observed for nine days; at the end of which time, one out of seven punctures inoculated with virus of the seventh or eighth day, presented the appearance of a tubercle. On the tenth day, this tubercle had all the characters of the vaccine vesicle; by the fifteenth day the vesicle reached its acmé, and was 'truly splendid.' Decline commenced on the sixteenth day, the crust was well formed on the seventeenth, but was rubbed off prematurely. In this experiment the vesicle was retarded five days; the usual period of maximum development of the variolo-vaccine pock being the tenth day. In a second experiment, the first inoculation failed. After re-inoculation, four out of the seven punctures looked purplish or livid on the fifth day, and were vesicular, with incipient central crusts on the sixth. By the tenth day they had attained their acmé. On the eleventh, decline had commenced, and progressed gradually, till the twenty-sixth day, when the crusts fell, leaving behind them smooth rose-coloured pits\*."

This method of procuring *a new lymph* for vaccination has had many advocates; but in consequence of the failure of often-repeated experiments, it has been nearly, if not entirely, abandoned. Besides which, experience has demonstrated that until the variolo-vaccine

\* Diseases of the Skin, p. 77 & seq.

lymph has undergone several removes, it does not take freely, nor does the disease produced by it pass with regularity through the respective stages. It requires, therefore, to be assimilated by the tissues, or to become *humanized*, before it can be depended on for vaccination. For similar reasons, we are of opinion, that neither the *variolation* nor the *vaccination* of sheep can be relied upon for yielding a fresh supply of lymph, although Sacco speaks of the advantageous employment of vaccine lymph "regenerated" in the system of the sheep.

Whether the product of the natural *ovine vesicle* can be substituted for the *vaccine*, is a vexed question, on which we will presently make some comments, prior to which we shall insert the details of a case of *small-pox inoculation*, succeeded by *ovination*.

Nov. 10.—An Irish sheep was inoculated with the virus of the small-pox of the human subject, six punctures being made in different parts, into which the matter was inserted in a fluid state.

Third day of *variolation*.—The incisions are more inflamed than would be the case if the skin had been simply punctured, but no *specific effects* are produced.

Sixth day.—The inflammation has subsided, and the site of the wounds can scarcely be detected. We therefore *ovinated* the patient, using for the purpose some points charged with impure lymph procured from a case of confluent variola following inoculation. See page 112, Nov. 15.

Third day of *ovination*.—Three of the places have taken: all symptoms of the previous operation have passed off.

Fifth day.—One incision on the side of the sternum

is much more inflamed than the others; two stigmata have formed near it, and the contiguous absorbents are enlarged and corded. The animal is dull, and takes but little food.

Sixth day.—All the symptoms are aggravated, and papulæ can be felt deeply located in the dermis.

Seventh day.—Papulæ more perfected, but distinct. The inflammation on the brisket has extended so as to join the stigmata; the swelling is more, the pain on pressure greater, but the redness less than ordinary.

Ninth day.—The ovinated places are vesicular, with the exception of the one before mentioned: the eruption has undergone very little change, but the general febrile action is diminished.

Eleventh day.—Some of the papulæ have disappeared; the inoculated vesicles are distended with *limpid fluid*, and pus is forming on the edge of the inflamed spot on the breast.

Thirteenth day.—Suppuration steadily increases; the epidermoid covering of many of the papulæ is blanched and elevated, but no fluid can be collected from beneath it. The animal's health is much improved.

Fifteenth day.—Ulceration of the skin of the breast has commenced; the ovinated vesicles are turbid: the eruptive vesicles being more fully matured, we charged some points from them for immediate use, but the lymph was impure.

Twentieth day.—Brown crusts of cuticle are desquamating from the papulæ. The suppurative action is going on in the punctures, and a large slough is separating from the brisket.

Twenty-second day.—The ovinated places are all

ulcerating; the ulcers are, however, superficial in the incisions on the inner part of the thighs, but deep and extensive on the side of the sternum.

As the specific features of this case had now passed away, it is not necessary to continue the report; we should state, however, that the ulcer on the brisket very slowly granulated, and was upwards of three weeks in healing. It is evident that the previous variolation did not affect either the progress or termination of the ovination, and in this particular, as well as in the local effects produced by the small-pox virus, the experiment may be taken as a type of others.

The susceptibility of either man or animals to be affected by an inoculation with the virus of sheep-pox is, as before observed, a subject on which great difference of opinion prevails. But, nevertheless, we must offer a few remarks upon it; *for the transmission of the ovine lymph to the ox tribe is said by many to be the best means of rendering it more suited for the inoculation of sheep; and it is likewise averred that ovination of the human subject is equal to vaccination as a prophylactic against small-pox.* Sacco states, "that inoculation with the virus of the small-pox of sheep is often accompanied with a general eruption, but if the same fluid be conveyed into the system of man, or the cow, it never produces more than a local disease; and if the ichor which has thus been *regenerated in either* be used to inoculate sheep, it will be found that its effects are invariably confined to the punctures. This," he adds, "is very important; for in the event of an outbreak of sheep-pox, if we cannot procure lymph to vaccinate the animals, we may ovinate the human

subject or the cow, and thus destroy the virulence of the virus." And again, he says, "as it is found that the *vaccination* of sheep gives immunity, so likewise does the *ovination* of man render him secure against the small-pox."

On a matter of so much importance as this, more especially as the experiments adopted in this country have been unattended with success, we shall not hesitate to subjoin copious extracts from the writings of the same authority. "The first time," says he, "that I saw the small-pox in sheep, was in 1804, when passing through Capua, in the kingdom of Naples, my attention was directed to seven sheep which a man was driving into a butcher's shop, and which had such a dejected appearance, that I stopped to examine them. Having satisfied myself that the animals were affected with variola, I carefully collected some of the virus from the finest pustules [?] with the intention of experimenting with it as early as possible. On Christmas day of the same year, on my way home, I called on Dr. Legni, of Cattolica, and informed him of my wish : he procured six children, and these we inoculated with the ichor, which was still fluid. For the sake of comparison, two other children were vaccinated with genuine lymph. A month afterwards Dr. Legni informed me that all the cases had gone on in the ordinary way, and that he had not observed any marked differences between the effects produced by the vaccine and those of the ovine inoculation. He also stated that he had since used the ovine lymph on nearly 300 children with the most complete success."

"I subsequently determined to inoculate two chil-

dren with ovine lymph in one arm and vaccine in the other : the vesicles were so similar in appearance that had I not marked the arms I should have been unable to distinguish the one vesicle from the other. A few days after the desiccation of the vesicles, the children were inoculated with the virus of human small-pox ; but no consequences, either local or general, resulted therefrom. In Fosdinovo I operated with the same ichor on a number of children, and also on *a cow* near Aulla ; many of the cases I left under the care of M. Magnani, surgeon, of the latter place, who favoured me with the following details :—‘ On the 8th and 11th ult., December 1806, I visited the four boys that you had inoculated with ovine virus, and found that two of them were affected ; one had two fine pustules [?] on each arm, the other only one on the right arm. The pustules [?] were similar to those of vaccine, and surrounded with a red zone ; but a minute examination shewed that their contents were on the eighth day more yellow than in that disease, a condition which they retained up to the period of the formation of the crusts. At my first visit I obtained some ichor from the pustules [?], which was serous but *not limpid*. I inoculated two children with this, and on the seventh day the pustules [?] were filled with *a limpid fluid*. From these, three other individuals were inoculated, and on the eighth day the contents of the pustules [?] were *both limpid and crystalline*, as in the true vaccine.

On examining *the cow*, I found but one pustule [?], which was situated on her udder : it was distended with a yellow and turbid fluid. I used this on two boys ; the disease produced by it passed regularly through its

*stages, and I could detect no difference between the product of the pustules [?] and that of vaccine\*."*

In his directions for the performance of the operation, Sacco states, that when we inoculate children, or cows, with primary ovine lymph, it is advisable to do so in six or eight places, as frequently not more than one will take; but the ichor which this yields may always be relied on for future use.

Similar experiments to those above mentioned have been instituted both by Mr. Ceely and Mr. Marson; and, conjointly, these gentlemen have performed not less than 250 inoculations with the virus of sheep-pox. The first trial made by Mr. Marson seemed to indicate the capability of the human subject to receive the disorder: the result, however, negatived the expectation, and in every instance the attempts may be said to have failed. In a letter received from Mr. Ceely, April 9, 1848, that gentleman gives the following valuable particulars on this subject:—

"*Human Ovinations.*—I ovinated twenty-five subjects, whose ages ranged from three to fifteen years; some twice and thrice over; in none were there fewer than six punctures each time, making not less than 180 punctures; no specific disease resulted; but a prompt and devious papular or diffuse inflammation, or, more rarely, a common local pustular. In the majority of these twenty-five individuals the virus employed was liquid. When very recently charged points were used, subsequent re-inoculation with liquid virus was had recourse to, but with no other effect. Nearly

\* Trattato di Vaccinazione, Capitolo 9, p. 144 & seq.

all the above subjects were shortly afterwards vaccinated with current vaccine lymph, which in each case exhibited the normal effects. I may as well add, also, that the same kind of ovine virus which did not succeed on children, took promptly on sheep."

Thus it is evident that the difficulty of conveying the small-pox of sheep to man is greater than Sacco would lead us to suppose; even if we admit the susceptibility of the human subject to be affected by the disease. And with regard to the inoculation of the cow with ovine virus, a practice which is likewise advocated by the same author as a certain method to purify the lymph and render it mild, we have to observe that our efforts to accomplish this have also been unsuccessful.

On Oct. 19, a heifer was ovinated with primary lymph of good quality, which was inserted while yet fluid into four punctures on the labia, and also smeared over several groups of scratches on the teats; in addition to this some crusts were reduced to powder, and placed beneath the cuticle on the inside of the ears. No specific effects followed. The experiment, with slight modifications, was thrice repeated on the same animal, and each time failed.

On Nov. 5, another heifer was inoculated in three punctures on each side of the labia, and in two others a little below it: the lymph used was the second remove from the sheep. The incisions inflamed rather more than ordinarily; but all the effects had passed off by the seventh day.

Nov. 16.—This animal was re-ovinated with fresh lymph taken from a *confluent case* of sheep-pox, which also proved ineffective. The experiment was again repeated without success.

A third heifer was several times inoculated in different ways, and on various parts of the body, all of which failed. And besides these cases of our own, Mr. Ceely has attempted, but in vain, to communicate the disease to the ox tribe. Hence our experience agrees with that of Hurtrel D'Arboval, who maintains that ovine variola cannot be transmitted to the cow by inoculation.

As we have given in full the observations of Sacco, we will insert those of D'Arboval on this subject, who thus concludes his article on *Clavelization* :—“ My task would be completed, were it not necessary to add a few words on the inoculation of man and different animals with the virus of sheep-pox. The attempt has been made to give security against attacks of the small-pox, by substituting ovination for vaccination ; and for this purpose children of various ages have been subjected to the operation. The inflammation which has come on in the punctures has declined in a few days, without being attended with any specific effects.

“ Many children have been ovinated several times in succession, but it has invariably failed. These same children have afterwards been vaccinated ; and at the usual time the vaccine disease has been developed, and has passed regularly through its course ; while simultaneously with these experiments, sheep have been inoculated with the same virus, and the small-pox has been produced.

“ These facts prove, that ovination cannot supersede vaccination ; hence, also, we cannot admit that the small-pox of man and of sheep, and the vaccine disease of the cow, are truly identical.

“ Efforts to communicate variola ovina by inocula-

tion to horses, oxen, goats, deer, pigs, dogs, monkeys, rabbits, and various birds, have likewise been unsuccessful\*."

By comparing these statements of the preventive power of vaccination, and the susceptibility of other animals to be affected by ovine-pox, it will be seen that the French and Italian authors hold opposite opinions. We have no wish to decide between these authorities with the amount of knowledge we at present possess of a disease which has so recently visited this country, and that, for the first time in our experience, although we readily admit that the experiments we have instituted to settle these questions have confirmed the assertions of Hurtrel D'Arboval. It was on this account that we decided on giving copious extracts from their writings, so that others might be stimulated to investigate the disputed points with a view to their perfect elucidation. Doubtless, much remains to be done; yet we trust that the succinct history of the introduction of the disease, and the means adopted to ascertain its true nature, and the laws that regulate its extension, &c., which are herein recorded, may assist the labours of future inquirers. We are quite contented that the honour of perfecting the investigation of this important subject shall devolve on those who are far abler than ourselves to do it justice, and shall be satisfied if the humble merit of having acted as a pioneer be conceded to us.

\* Art. *Clavelization.*



## EXPLANATION OF THE PLATES.

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PLATE I.—Represents a portion of the skin, from which the wool has been detached, in the papular stage of the disease; some of the nodules being confluent, and others distinct.

PLATE II.—Gives a view of the inner part of the hind leg, with the affection in its vesicular stage. A few of the papulæ are yet uncovered by vesicles.

PLATE III.—Shews the crustaceous stage, as it appears when the fall of the scabs has been interfered with by local injuries.

PLATE IV.—*Fig. 1.* A section of the head of a sheep, exhibiting *mucous vari* on the Schneiderian membrane.

*Fig. 2.* The larynx and trachea laid open, to shew the development of vari on their lining membrane.

PLATE V.—The progress of ovination as it is observed from the third to the twenty-fourth days. The figures respectively named, the *third, fourth, and fifth days*, represent the commencement and spread of the variolous inflammation: the *eighth day* exhibits the central depression of the ovinated spot, and a stigma near to it, also the efflorescent rash which precedes the papulæ. The *tenth day* shews small vesicles arranged in a crescentic form on the site of the inoculation: the *thirteenth day*, a large vesicle covering the same place: the *eighteenth day*, the elevated cuticle still adhering as a dark coloured scab: and the *twenty-fourth day*, ulceration of the dermis going on beneath the epidermis.

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## DIRECTIONS TO THE BINDER.

PLATE III to be placed as a frontispiece, and the remainder of the plates at the end of the volume.



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Fig. 1.

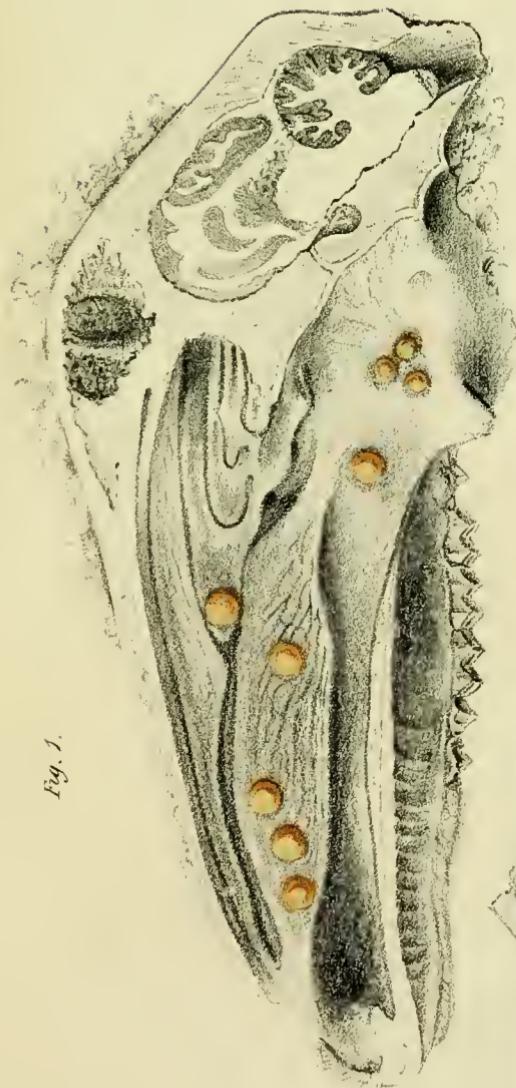
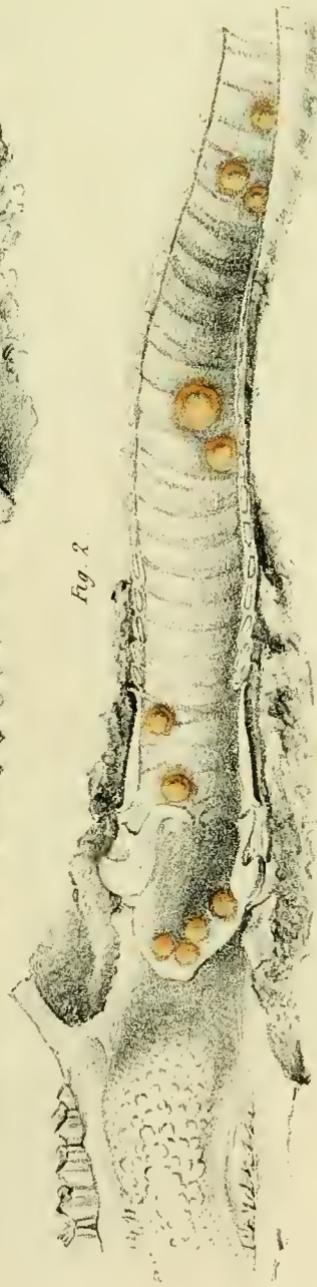


Fig. 2.





Third day after inoculation

4<sup>th</sup> day3<sup>rd</sup> day5<sup>th</sup> day13<sup>th</sup> day10<sup>th</sup> day18<sup>th</sup> day24<sup>th</sup> day







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